A Guide to Land Use Planning in Coastal Areas of the Maritime Provinces

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TABLE OF CONTENTS

LIST OF FIGURES v
LIST OF TABLES vii
LIST OF ACROYNMS viii
ABSTRACT ix
RÉSUMÉ x

1. LAND USE PLANNING AND COASTAL AREAS 1
1.1 INTRODUCTION 1
Fact Sheet: Land-Use Planning and Coastal Areas 3
Fact Sheet: Management Tools for Coastal Land-Use Planning 6

2. COASTAL ENVIRONMENTS AND MARINE ECOSYSTEMS OF THE MARITIME PROVINCES 8
2.1 THE SEA COAST AND ITS BIOLOGICAL COMMUNITIES 8
2.2 GEOLOGY OF THE COAST 9
2.3 TYPES OF COASTAL FEATURES 9
2.4 BIOLOGICAL COMMUNITIES IN COASTAL WATERS 10
2.5 INFLUENCE OF PHYSICAL FACTORS ON BIOLOGICAL COMMUNITIES 11
2.6 BIOLOGY OF ROCKY SHORES 12
2.7 BIOLOGY OF SANDY ENVIRONMENTS 13
2.8 SHELTERED COASTAL ENVIRONMENTS 13
2.9 BIOLOGICAL LIFE IN THE COASTAL ZONE 14
Fact Sheet: Intertidal Flats 16
Fact Sheet: Salt marshes 20
Fact Sheet: Bedrock Shores 24
Fact Sheet: Sand Beaches 27
Fact Sheet: Boulder/Cobble Beaches 29
Fact Sheet: Sand Dunes 31
Fact Sheet: Lagoons/Barachois 33
Fact Sheet: Inlets and Estuaries 35
Fact Sheet: Dykes and Dykelands 38

3. COMPENDIUM OF TOOLS AND INSTRUMENTS FOR LAND USE PLANNING IN THE COASTAL ZONE 41
3.1 LAND USE PLANNING TOOLS 41
Fact Sheet: Coastal or Shoreline Buffer Zones 43
Fact Sheet: Coastal Classification 51
Fact Sheet: Non-Point Source Pollution 54
Fact Sheet: Public Involvement 61
Fact Sheet: Coastal Land-Use Planning and Canadian Law 64
Fact Sheet: Zoning 68

4. FRAMEWORK OF COASTAL LAND USE PLANNING IN THE MARITIME PROVINCES 76
4.1 INTRODUCTION 76
4.2 NEW BRUNSWICK 77
4.3 NOVA SCOTIA 78
4.4 PRINCE EDWARD ISLAND 79
Fact Sheet: Coastal Planning in New Brunswick 80
Fact Sheet: Coastal Planning in Nova Scotia 83
Fact Sheet: Coastal Planning in Prince Edward Island 86
4.5 GOVERNMENT OF CANADA 88

5. PRIMER ON COASTAL STRUCTURES 92
5.1 COASTAL STRUCTURES 92
Fact Sheet: Coastal Structures—Design and Construction Principles 94
Fact Sheet: Multipurpose Structures in the Coastal Zone 98
Fact Sheet: Coastal Protection and Hazard Control—Overview and Principles 105
Fact Sheet: Coastal Protection and Hazard Control—Structures for Shore Protection and Sediment Management 107

6. ACKNOWLEDGEMENTS 113

7. BIBLIOGRAPHY AND OTHER INFORMATION SOURCES 114

APPENDICES
APPENDIX A – Coastal Planning in New Brunswick: Relevant Jurisdictions and Legislation 123
APPENDIX B – Coastal Planning in Nova Scotia: Relevant Jurisdictions and Legislation 142
APPENDIX C – Coastal Planning in Prince Edward Island: Relevant Jurisdictions and Legislation 155

LIST OF FIGURES

Figure 1.1. The coastal zone 4
Figure 1.2. Extent of the coastal zone 4

Figure 2.1. Pocket beach, Chignecto Bay, Nova Scotia 9
Figure 2.2. Types of coasts located throughout the Maritime Provinces 10
Figure 2.3. Steeply sloping bedrock shore, Chebucto Head, Nova Scotia 12
Figure 2.4. Rocky seacliffs, Magdalen Islands, Quebec 13
Figure 2.5. Boulder and cobble beach, Arichat, Nova Scotia 14
Figure 2.6. Sand flats with sandbars, Prince Edward Island 16
Figure 2.7. Semipalmated sandpipers on Bay of Fundy mudflats 18
Figure 2.8. Salt marsh, Windsor, Nova Scotia with mudflat in background 20
Figure 2.9. Sandy beach and dune system, Cavendish Beach, Prince Edward Island 27
Figure 2.10. Cobble beach and berm, Lockeport, Nova Scotia 29
Figure 2.11. Boulder beach, Guysborough County, Nova Scotia 30
Figure 2.12. Sand dune and beach 31
Figure 2.13. Bay of Fundy dyke 38

Figure 3.1. Vegetated buffers for construction and work sites 44
Figure 3.2. Coastal activities in zone A 46
Figure 3.3. Acceptable activities in zone B 46
Figure 3.4. Coastal types 51
Figure 3.5. Activity-based land use classification system—Nova Scotia 52
Figure 3.6. New Brunswick coastal types 53
Figure 3.7. Information for public education approaches for typical non-point sources in coastal areas 55
Figure 3.8. Example of an erosion management design from a Nova Scotia subdivision development plan 60
Figure 3.9. Example of a public education plan included in a Nova Scotia subdivision development plan 63
Figure 3.10. Topic Areas for Municipal, Provincial and Federal Policy Objectives 65
Figure 3.11. Typical Coastal Planning Policies and Appropriate Management Techniques 66
Figure 3.12. Provincial policy statements 67
Figure 3.13. Legal instruments for environmental planning in British Columbia 67
Figure 3.14. Open space zoning—undeveloped coastal areas 69
Figure 3.15. State of Maine approach to coastal zoning 70
Figure 3.16. Dykelands zoning—Nova Scotia 71

Figure 4.1. Fisheries Act—key provisions 89

Figure 5.1. Types of coastal structures 94
Figure 5.2. Five rules for design of coastal structures 96
Figure 5.3. Bridge and bulkhead 98

LIST OF FIGURES (continued)

Figure 5.4. Pier 99
Figure 5.5. Wharves versus piers 100
Figure 5.6. Pier basics 100
Figure 5.7. Concrete boat ramp 101
Figure 5.8. Nova Scotia Crown land boat permit 102
Figure 5.9. An approach to shoreline construction and stabilization 106
Figure 5.10. Groyne 107
Figure 5.11. Jetty 107
Figure 5.12. Boulder revetment for landing 108
Figure 5.13. Bulkhead 109

LIST OF TABLES

Table 3.1. Coastal buffer zones in Prince Edward Island 47
Table 3.2. Shoreline buffers and setbacks from New Hampshire—shoreline protection standards 50
Table 3.3. Planning and management tools for non-point source pollution 58
Table 3.4. Approaches to community involvement in land management 62
Table 3.5. Overview of zoning approaches 71
Table 3.6. Zoning designations for rural and urban land-use in coastal areas, State of Washington 74

Table 5.1. Construction materials for shoreline protection and sediment management 109

LIST OF ACRONYMS

AERC	Agriculture and Environmental Resource Conservation Program (Prince Edward Island)
CLI	Canada Land Inventory
CPA	*Community Planning Act* (New Brunswick)
DFO	Department of Fisheries and Oceans (Fisheries and Oceans Canada)
DOT	Department of Transportation (Federal)
EIA	Environmental Impact Assessment
EPA	*Environmental Protection Act* (Prince Edward Island)
IRAC	Island Regulatory Appeals Commission (Prince Edward Island)
IRM	Integrated Resource Management
MGA	*Municipal Government Act* (Nova Scotia)
MPA	Marine Protected Area (through Department of Fisheries and Oceans)
MPS	Municipal Planning Strategy
NB	New Brunswick
NBDAFA	New Brunswick Department of Agriculture, Fisheries and Aquaculture
NBDELG	New Brunswick Department of Environment and Local Government
NBDHW	New Brunswick Department of Health and Wellness
NBDNR	New Brunswick Department of Natural Resources
NBDNRE	New Brunswick Department of Natural Resources and Energy
NMCA	National Marine Conservation Area (through Parks Canada within Heritage Canada)
NPS	Non-Point Source (pollution)
NS	Nova Scotia
NSDAF	Nova Scotia Department of Agriculture and Fisheries
NSDNR	Nova Scotia Department of Natural Resources
NSDOEL	Nova Scotia Department of Environment and Labour
PEI	Prince Edward Island
PEIDAF	Prince Edward Island Department of Agriculture and Forestry
PIEDFAE	Prince Edward Island Department of Fisheries, Aquaculture and Environment
SNSMR	Service Nova Scotia and Municipal Relations
SPA	Special Planning Areas (Prince Edward Island)
SPI	Statement of Provincial Interests (Nova Scotia)
WSDR	Watercourse Setback Regulation (New Brunswick)

ABSTRACT

Land-use planning is an essential element in the integrated management of Canada's coastal zone as human usage of land and water invariably results in impacts to the environment. For planning in the coastal zone—a broad region including watersheds and lands bordering the ocean, as well as the coastal ocean itself—this means looking at and involving social, economic, political and environmental elements. This guide to land-use planning in coastal areas has been prepared to provide information that will assist in coastal land-use planning, with a particular focus on the Maritime Provinces. The report is divided into a series of overviews and fact sheets that cover key land-use planning and related topics, including coastal environments and maritime ecosystems, legislative frameworks for planning, and engineering aspects of coastal structures. It presents desirable approaches and best management practices both from the Canadian experience and from overviews of land-use planning in other areas, in particular the neighbouring coastal states of both East and West coasts of North America which have a long history of experience with coastal zone management.

RÉSUMÉ

La planification de l'utilisation des terres est un élément essentiel de la gestion intégrée de la zone côtière au Canada, car l'usage que font les humains de la terre et de l'eau a invariablement des effets sur l'environnement. Dans le cas de la planification de la zone côtière – vaste région comprenant les bassins hydrographiques et les terres qui bordent l'océan, ainsi que les eaux côtières elles-mêmes - cela nécessite de tenir compte des aspects sociaux, économiques, politiques et environnementaux de cette utilisation et de faire participer au processus les intervenants dans ces domaines. Le présent guide de planification de l'utilisation des terres dans la zone côtière a été établi dans le but de renseigner les planificateurs, particulièrement ceux des provinces Maritimes. Le guide comprend une série d'aperçus et de listes de points saillants traitant de la planification de l'utilisation des terres et de sujets connexes, notamment des milieux côtiers et des écosystèmes marins, des cadres législatifs de planification et des questions de génie technique associées aux structures côtières. Il présente les approches souhaitables et les pratiques exemplaires tirées des expériences réalisées au Canada et des aperçus sur la planification de l'utilisation des terres dans d'autres régions, en particulier dans les États côtiers voisins des côtes est et ouest de l'Amérique du Nord, qui ont une longue expérience de la gestion de la zone côtière.

1. LAND USE PLANNING AND COASTAL AREAS

1.1 INTRODUCTION

The *Oceans Act,* proclaimed in early 1997, brought a major shift in the way Canadians look at the oceans that make up our coastal waters and how we manage them. In addition to basic changes such as defining our territorial limits and separating federal and provincial responsibilities, the *Oceans Act* committed Canada—through the Department of Fisheries and Oceans as the administering agency—to integrated management[1] of Canada's oceans and the adjacent coastal zone. Integrated management involves stepping back to see the whole picture and looking at it from different perspectives and points of view, rather than looking at individual pieces of a puzzle in isolation. In dealing with the coastal zone—a broad region including watersheds and lands bordering the ocean, as well as the coastal ocean itself—this means looking at and involving the social, economic, political and environmental elements that make up today's society as they all impact the health of our coastal waters.

[1] *Integrated management*—A comprehensive and coordinated approach to planning and decision making, based on a balanced consideration of the full range of interests and associated ecosystem, social and economic objectives for a management area. This involves the setting of planning and management goals, objectives, strategies, and policies in a collaborative framework among all regulators, resource users and interests.

Land-use planning is an essential element in integrated management of Canada's coastal zone. Human usage of land and water invariably results in impacts to the environment. The cumulative effects of all our activities can have serious consequences for biological systems. The waters in the coastal zone are one of the most productive and sometimes the most sensitive, yet these areas—the coastal areas of lakes, rivers and the ocean—are the most populous and the most developed. Managing human activities in coastal areas in ways compatible with the environment can have a significant overall impact in our success at maintaining healthy and productive environments.

This guide to land-use planning in coastal areas has been prepared to provide information that will assist in land-use planning with particular reference to coastal areas, focusing on the Maritime Provinces. This is a step towards ensuring coastal development and management in these areas takes place in a more integrated and, hopefully, a more sustainable manner.

The report is divided into a series of overviews and fact sheets that cover key land-use planning and related topics. It presents desirable approaches and best management practices both from the Canadian experience and from overviews of land-use planning in other areas, in particular the neighbouring coastal states of both the East and West coasts of North America which have a long history of experience with coastal zone management.

One element of successful land use planning in the coastal zone is an understanding of the environments and how they will be affected by coastal development. Examining planning approaches used in coastal zones elsewhere can provide insight into how planners have dealt with similar problems. Finally, the engineering aspects of coastal structure to both use and protect the coastline are important to understanding current and future developments. Separate sections in this report are devoted to all these key aspects of coastal land-use planning.

Land-Use Planning and Coastal Areas

Land-Use Planning

- Planning is the process for determining what is to be achieved in the future and clarifying the steps required to achieve it.
- Land-use planning today aids in determining sustainable goals for development of human communities and presents ways to achieve them. Coastal land-use planning is land-use planning applied to the coastal zone.
- Contemporary coastal land-use planning is made up of elements from urban/town planning and regional development, protected area (conservation) planning, strategic environmental planning, resource planning and marine planning.
- All levels of government are important stakeholders in coastal planning. They have a primary role in policy and legislation, consultation and liaison and regulation and enforcement.
- Land-use planning can contribute to maintaining sound ecological systems and the natural beauty of a given area. Healthy ecological systems contribute to and support healthy economic and social systems, thus being an important element in sustainable development.

The Coastal Zone

- The Coastal Zone is an area or zone of transition where terrestrial and marine environments meet and interact to form distinctive environmental conditions. It is an area that has particular human, biological and physical features. Human activity is patterned in exclusive ways in the coastal zone, shaped by a moderated climate, unique resources and other such amenities. Conversely there are also the dangers of natural disaster and the unrelenting erosion by the sea. Ecologically, habitats and species in the coastal zone are specially adapted to these environmental conditions.

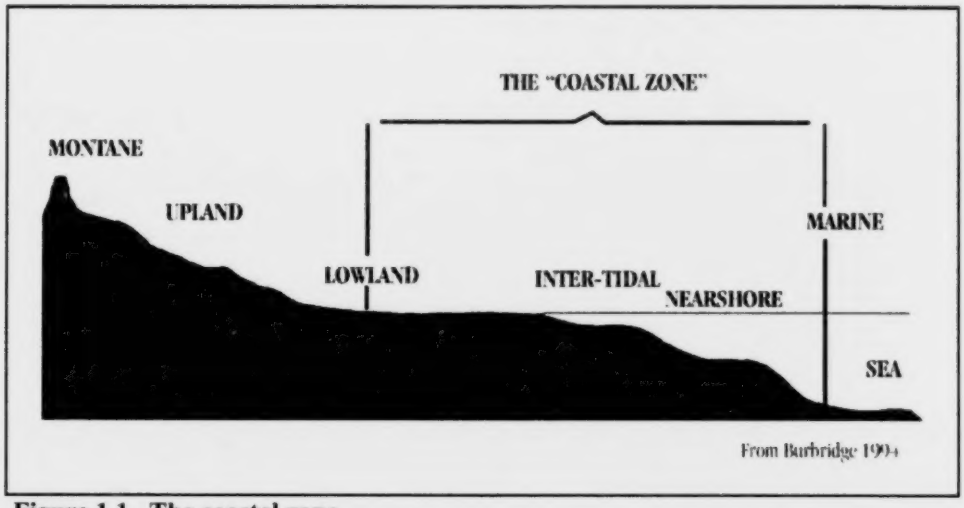


Figure 1.1. The coastal zone

The coastal zone embraces not only inshore waters and intertidal areas, but also extensive tracts of land. Land-use management of the coastal zone thus involves managing land and human activities not only immediately influenced by the ocean, but also in watersheds that drain into coastal areas. Some watersheads can extend 50 kilometres or more from the coast. Land-use management with a view to conserving the coastal zone is especially important in provinces, such as Nova Scotia and Prince Edward Island (PEI), where no location is more than 50 km from the sea.

Extent of the Coastal Zone

A practical, though arbitrary limit, for the coastal zone for land-use planning purposes is 10 kilometres landward of the limit of tidal waters. Within that zone, the planning approach should have special provisions combined with measures that deal with issues that occur only in the immediate coastal area. Beyond that zone and inshore to at least 50 km, a land-use strategy should be adopted that confers the highest degree of protection of surface waters both in areas distant from and adjacent to the coast.

Figure 1.2. Extent of Coastal Zone

Principles for Land-Use Planning in the Coastal Zone

- Planning activities should occur within the broader context of collaborative approaches to oceans and coastal management, including the use of inclusive and transparent planning, advisory and decision-making processes involving all interested and affected parties.
- Land-use planning should wherever possible follow an integrated approach, in which planning activities are always considered together with other issues, concerns or activities. Integrated approaches should be included in planning strategies and other formal planning mechanisms.

- Planning in coastal areas should consider not only the coastal zone, but also adjacent lands that form the coastal watershed, and should consider or be based on watershed units wherever possible.
- The use of buffer zones within land-use planning has proven to be an effective tool for achieving objectives.
- Land-use planning should aim to institute, if possible, higher levels of protection in natural and undeveloped areas than in developed ones to maintain these areas in a near pristine state.
- Planning should use precautionary approaches to 'err on the side of caution' when measures potentially affect the natural environment or human uses of the land. Precautionary approaches can reduce the cost of corrective measures at a later date.
- Short and long-term planning and development goals should be considered.

Management Tools For Coastal Land-use Planning

Planners have at their disposal a wide range of tools for coastal land-use management.

Policy

- Is important in decision-making involving both the public and the private sector.
- Policies regarding coastal management are widespread and can be applied at many different levels (e.g., international to local levels).

Legislation

- Expressed as an Act or Law and related regulations.
- Important in terms of expressing concepts as plans and management actions, and in defining or clarifying institutional conditions.
- As it is difficult to change laws, legislation can provide permanence to actions.

Guidelines

- Less formal than legislation, policies or regulations.
- Often can produce inconsistency and decision-making bias, but are broad and flexible.

Zoning

- One of the most powerful tools in coastal management and planning. Related tools include time partitioning, facility/infrastructure restrictions, permit/license quotas and production quotas.
- A way to spatially separate uses and control incompatible uses.
- An important tool as it can be used to integrate complex and often complicated management objectives.
- Can be used for ecological, conservation and protected area management.
- Coastal or shoreland buffers are important zoning tools for minimizing non-point source pollution (i.e., human septic and agricultural wastes) and coastal erosion. Buffer zones (recommended minimum of 30 m) included in master plans and bylaws can be used to regulate permitted uses near mudflats.

Coastal Classification or Typing

- Summarizes coastal environments based on a range of factors including exposure, slope, coastal geology, habitat type and biological sensitivity.

Community Involvement and Public Education

- Gives stakeholders an opportunity for input into management decisions regarding land-use in all coastal areas, improves communication and increases environmental awareness in agencies, governments and the community. Public education enhances environmental awareness and understanding of sustainability and aids in putting knowledge and principles into action to minimize environmental degradation.

Regulation and Enforcement

- Permits and licenses for harbour works, fishing, tourist programs, coastal structures, etc.
- Enforcement is used to allow for compliance with Acts, permits, licenses, policies or plans related to legislation; encourages compliance.

Community Participation

- Customary (local/traditional) practices and/or history can aid in coastal management and planning.
- Collaborative and community-based management aids in dealing with local coastal problems.
- Traditional Ecological Knowledge

Capacity-Building

- Communications, education and training can aid in coastal planning and management initiatives.
- Research and data management provides input to processes.

Recreation and Tourism Management

- Planning focused on enhancing users' recreation experience while protecting the coast.
- A need for tourism planning to be integrated with other forms of planning.

Technical Tools

- Environmental impact assessments.
- Risk hazard assessment and management.
- Landscape and visual resource analysis.
- Economic analysis.
- Social/cultural analysis.
- Geographic information systems.

2. COASTAL ENVIRONMENTS AND MARINE ECOSYSTEMS OF THE MARITIME PROVINCES

2.1 THE SEA COAST AND ITS BIOLOGICAL COMMUNITIES

The sea coast and the adjacent submerged seabed are the product of geological processes and physical forces, such as wind, waves, currents, tides and ice. Biological organisms and their related communities and ecosystems, on the other hand, are ubiquitous in the ocean and the coastal environment as they take every opportunity to colonize and use the physical framework of the land and water. Biological organisms can modify the physical environment to some degree, but physical factors predominate.

Some knowledge of the geology and biology of coastal areas is important for understanding coastal processes and for approaching coastal land use management in the coastal zone. Activities in coastal areas should always attempt to minimize impacts on the local marine environment and associated wildlife. This section presents an overview of relevant information on the geology and biology in the coastal zone of the Maritimes region.

2.2 GEOLOGY OF THE COAST

The basic character of the coastline is set by the geological formations. Rock and soil formations of various kinds form the coastline. They result in different kinds of environments that present challenges for planners. Coasts are either formed from bedrock or from material, such as boulder, gravel, sand, silt and mud (collectively known as unconsolidated material), derived from the erosion of bedrock or other deposits along the coast. Coasts having bedrock as the major structural component have a different character than those where soil or glacial deposits (unconsolidated material) predominate. In the former, for example, where erosion rates are less, there tends to be a smaller amount material available for the formation of beaches. Shorelines comprised of glacial till, such as drumlins, tend to have a more mobile character. These shorelines (known as erosional) erode rapidly forming cliffs, providing abundant material for beach development and deposits in sheltered environments. Areas where sediment accumulates and where the coast is growing, such as beaches, sand dunes, mudflats and salt marshes, are known as depositional environments.

Bedrock shorelines also can consist of different types of rocks with varying resistance to erosion. For example, resistant igneous granites or basalts contrast with more easily erodable shales and sandstones. The erosional patterns add to the distinctive character of the coast. For example, the eroding sandstone cliffs of PEI are distinctive from the unforgettable coastline of resistant granite at Peggy's Cove, Nova Scotia.

2.3 TYPES OF COASTAL FEATURES

In the Maritime Provinces coastlines are of two general types: bedrock (the primary material out of which the continents are made) or material such as glacial till, boulders, cobble, sand and mud, all of which are derived from bedrock. Bedrock shores include formations such as sea cliffs, intertidal rock tables and gradually sloping rock shores. Occasionally bedrock shores may have pocket beaches (localized deposits of sand or coarser material in bays or inlets on the coast). Bedrock shores can also be divided based on the types of rocks present, with certain types, such as igneous and metamorphic, being more resistant to erosion than softer sedimentary rocks, such as the sandstones that occur over much of the Southern Gulf of St. Lawrence and shales of Cape Breton Island. The rate of coastal erosion is of obvious interest to a planner working in the coastal zone.

Figure 2.1. Pocket beach, Chignecto Bay, Nova Scotia

Other deposits along the coast include sand and cobble beaches, sand/gravel bars and mud and sand flats. In addition, coastal bodies of water, including lagoons/barachois, and open water form important elements of the coastline morphology.

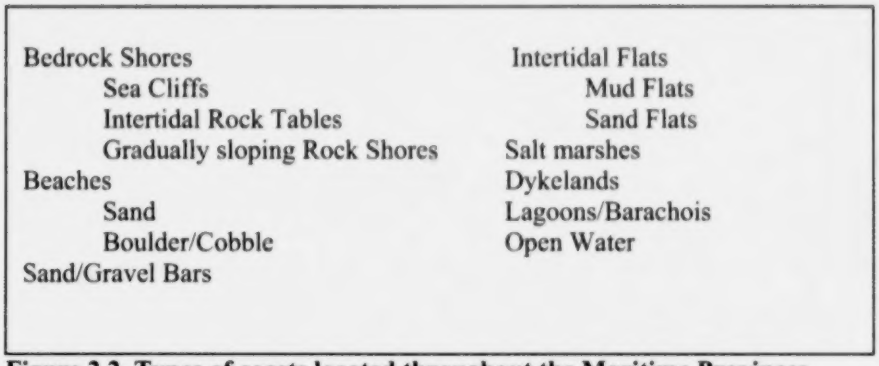


Figure 2.2. Types of coasts located throughout the Maritime Provinces

2.4 BIOLOGICAL COMMUNITIES IN COASTAL WATERS

Biological communities develop on coastal features. As the coastline character depends on the basic geology, the biological communities reflect the type of coast and the character of the adjacent water masses.

Aside from the biological communities we most usually see, such as the seabirds, the seaweeds along the coast, the animals in tide pools, the clams in mudflats and the occasional marine mammal, the biology of the waters in coastal areas is frequently invisible. Not until you look closely at the shore between tide marks and the life that grows on it, or spend some time on the sea, do you realize that a large proportion of the diversity of marine life has been missed. It is fair to say that every square centimetre of the environment—land and water—can be occupied at some time by biological organisms. The seabed and the water/air above it form the species' habitat.[2]

Distinctive *biological communities* and/or ecosystems are associated with different coastal types. For example, the rocky shores exposed to the open Atlantic Ocean have characteristic growth of dense beds of seaweeds from below low water to 10 metres or more in depth. In contrast, shallow, sheltered bays and inlets may support extensive 'fields' of eelgrass.[3] Benthic organisms, as well as a wide range of species that live in the water, inhabit both these 'bottom' environments. There is no general rule that states what particular type of community will be found, although certain communities will usually be found in certain situations. There also can be local variation due to a natural disturbance, such as storm surge or seasonal ice scour. As a result, particular species or communities will be found occasionally where they are not expected or are lacking from areas in which they would otherwise occur.

[2] Habitat is the typical environment and particular geographic region that a species inhabits.

[3] A grass with long narrow leaves which is completely submerged at low tide, and is often washed up on beaches.

Coastal areas also support 'pelagic' animals and plants that swim in the waters and move throughout the water column. These animals and plants are carried with the water, such as with tides and wind-induced currents, or move independently through migrations. While some pelagic species are readily visible, such as marine mammals, others, such as fish (e.g., herring, mackerel, shad) and marine invertebrates (e.g., jellyfish and shrimp) are more common. Although influenced by the regional setting, pelagic communities are similar throughout broad areas of coast. For example, a mackerel run is an annual event in most coastal areas in Nova Scotia.

Coastal lands and adjacent waters also support a host of other animals and plants associated with the sea. Birds, such as eagles and Osprey, also known as fish hawks, Canada Geese and Common Loons, spend time there. Shorebirds, such as plovers and sandpipers, also inhabit and rely on the marine environment of the coastal zone. Various other species, such as deer (which on the coast may occasionally eat seaweed), mink, raccoons and otter, use the shoreline and adjacent waters. All of these and many other species can be impacted to varying extents by activities in the coastal zone.

2.5 INFLUENCE OF PHYSICAL FACTORS ON BIOLOGICAL COMMUNITIES

Physical factors in the marine environment have a profound influence on biological communities found along the coast. Biological communities depend on the availability of solar energy. Within the aquatic environment, generally more sunlight is available in shallow waters where profuse biological development is found. The importance of decaying organic material or detritus—the remains of plants and animals containing stored food energy—in fuelling marine communities also is reflected by the many types of animals which utilize the detritus on the seabed. Microscopic plants from the water are also known to access the detritus. The communities that inhabit the intertidal zone at the high tide marks on rocky shores are sparse because the animals there must resist the daily cycle of change in temperature, salinity and dryness. Each day these areas are flooded and dried due to the tides, periodically impacted by waves, frozen and thawed in winter and heated and cooled in summer. Nonetheless, many organisms resist these conditions and live in these zones. Denser growth of plants and abundance of animals increases in the lower intertidal zone as the amount of submergence and more hospitable conditions increases.

Salinity is also important in determining the distribution of biological communities. Freshwater is lighter (less dense) than salt water and floats to the surface. In estuaries, the water that bathes the intertidal zone is initially fresher, gradually increasing in salinity as the estuary opens towards the open ocean.

Knowledge of exposure to wave energy, currents and tidal energy also is important in determining what kind of benthic communities may occur. Abundance and diversity of seaweeds is often greatest in the subtidal zone of exposed coasts, where the turbulent water movement aids in supplying nutrients for growth within the euphotic (light) zone. Seaweed growth is less towards the more sheltered inner parts of inlets where there is less

energy and the depth of the euphotic zone may be reduced. Rocky areas having rapid currents—such as the passages between islands in tidal areas—often have dense growth of seaweed and diverse animal communities.

2.6 BIOLOGY OF ROCKY SHORES

Rocky shores throughout the region usually have well-developed seaweed growth in the intertidal and subtidal zones. Intertidal zones support a range of seaweeds, typically rockweeds and other leafy macrophytes, harbouring or in association with diverse benthic invertebrate fauna assembledges. These seaweeds do not have roots, *per se*, and need hard and stable material to attach. In some areas the intertidal seaweeds (as well as some just below low water) are harvested commercially. For example, the northern coast of Prince Edward Island has a harvest of Irish Moss and coastlines in southwestern Nova Scotia support a major rockweed harvesting industry. The seaweeds of the intertidal zone and the immediate subtidal are influenced by the reduced salinities, especially in areas along the margins of inlets, which typically have rivers flowing in at their heads. Here seaweed growth is typically reduced, as is abundance and number of species. Even the shapes of plants differ from areas having more saline waters.

Submerged areas of bedrock or rocky bottom below the low tide level can consist of a range of predominantly coarse materials, such as bedrock outcrops, boulders, large and small rocks and sand and gravel. Seabed depressions nearshore, however, may have finer sediment, such as silt or clay.

Figure 2.3. Steeply sloping bedrock shore, Chebucto Head, Nova Scotia

In all areas of rocky bottom, seaweeds are most developed in the nearshore regions (within a few hundred metres of shore), but reefs and islands off the coast may have extensive growth on the surrounding seabed. Seaweed growth and diversity decrease in response to increasing depth. Areas not having rock on which seaweeds can anchor (as well as areas that do) frequently have abundant 'drift' seaweed, living plants that have broken off and move over the seabottom with currents.

The coarse seabed off rocky coasts, particularly when there is dense development of larger leafy macrophytic seaweeds collectively known as kelp, is some of the best habitat for lobster, crabs, and sea urchins as well as many other non-commercial fish and invertebrate species, such as ocean perch. As in other areas, seabirds and marine mammals can be found feeding in rocky coastal areas.

On eroding coasts, particularly in areas where glacial till predominates, the seabed is typically rocky in the subtidal zone. Erosion leads to the introduction of boulders, rocks and gravel which contributes to the rocky character of beaches and subtidal areas nearshore and further offshore. In these areas seaweeds can attach to boulders and develop seaweed beds that provide habitat for invertebrates, such as lobster.

2.7 BIOLOGY OF SANDY ENVIRONMENTS

Sand beaches are prominent features of coastlines exposed to high wave energy, and that have sandy sediment available from eroding shorelines or from nearby offshore deposits. While sand dunes and the associated grass communities figure prominently in beach areas, they also may have seaweeds in the subtidal zone, chiefly attached to hard bottom which may occur in patches. Here the seaweed development is much less extensive than on rocky shores. Waves, tides and currents frequently shift the sand in beach areas. These physical conditions present an inhospitable environment for plants and animals. As a result, the diversity of organisms and plants on beach zones is usually low compared with rocky shorelines. Nonetheless the diversity of sea life on the bottom at depths below these zones can be high and is attested to by the debris (shells of clams and snails, carapaces or outer skeletons of crabs, sea urchins, drift seaweed, egg cases) that wash up on the beach. Further offshore the bottom in the vicinity of a beach may grade into coarser sediment typical of many exposed coastlines. In these areas, the open water communities of biological organisms are more predominant.

Figure 2.4. Rocky seacliffs, Magdalen Islands, Quebec

Marram grass and other vascular plants stabilize sand dunes that occur above the high tide mark in sandy beach areas. The presence of the plants not only stabilizes the dunes, but aids in their creation by providing resistance to the wind and trapping sand, thereby enabling the dunes to build. However, they are subject to periodic removal by storm events.

2.8 SHELTERED COASTAL ENVIRONMENTS

Inlets and other sheltered environments, such as the lee of islands, headlands and river mouths, have some unique environments. The character of the biological communities found along their coasts is slightly different than those more common to open coasts.

Species that live floating or swimming in the water may occur throughout inlets. Many adult species enter inlets during their migrations along the coast, including lobsters and crab to deposit eggs, and juveniles often concentrate there to grow and mature because of the reduced wave, tidal and current energy and food availability. Inlets often have resident populations of shellfish, such as mussels, clams, scallops, crabs and lobster.

Seaweed communities on rocky bottom inlets and estuaries have fewer numbers of species, and a lower abundance of them, than communities found on exposed rocky coasts. This is due, in part, to the reduced wave energy and lower nutrient availability. Rockweeds are typically present in the intertidal zones and immediate subtidal zones, and co-exist with various animals, including barnacles, mussels, amphipod, crustacea, crabs, birds, sponges and periwinkles. Many fish species live seasonally in these areas. The availability of sheltered conditions also provides good nursery areas for juvenile stages of many species (e.g., Atlantic herring, winter flounder).

Shallow water nearshore areas can have a coarse bottom (e.g., bedrock, cobbles, gravel) reflecting the local source material and the resulting effects of wave action. As the water gets deeper, finer sediments, such as sand and mud, occur. Where inlets have some exposure to the open ocean the fine sediments may be sandy in texture. In the most sheltered sites, fine silty to muddy bottoms can be found. The deepest parts of inlets usually have a bottom sediment type consisting of clay and/or fine organic material primarily derived from plant detrius.

Figure 2.5. Boulder and cobble beach, Arichat, Nova Scotia

Soft bottoms in nearshore areas have various vertebrate fisheries, particularly flatfish and other groundfish. In addition, the shallow sandy/muddy environments in inlets and sheltered areas sometimes provide suitable sites for shellfish leases (i.e., oysters). Sheltered, shallow, sandy to muddy bottoms often have beds of eelgrass in the intertidal zone. Generally, extensive salt marshes fringe the shores of sheltered coastal areas in many parts of the Maritimes. These salt marshes are one of the most productive coastal environments and, at the same time, are some of the most threatened by human development.

2.9 BIOLOGICAL LIFE IN THE COASTAL ZONE

A complex variety of marine ecosystems occur in coastal areas of the Maritimes. Human activities in the coastal zone can negatively impact these ecosystems in many ways. Popular books, such as Rachel Carson's trilogy, *The Sea Around Us; At the Edge of the Sea;* and perhaps the most relevant *Under the Sea Wind*, have described these ecosystems and the effects of human activities on them. The ocean and its lifeforms should be placed at a high level in coastal planning, in the same way that terrestrial biological ecosystems, such as forests, surface waters (e.g., lakes and rivers) and wetlands (e.g., bogs, fens, ponds, marshes), are treated in conventional land-use planning activities.

The fact sheets that follow provide an overview of some of the major coastal environments and associated ecosystems in the Maritimes, as well as relevant planning

considerations. The intent is to stimulate an awareness, as well as to provide tools to help in planning patterns of land use in coastal zones that will be sustainable.

Intertidal Flats

What are intertidal flats?

- Occur in the intertidal zone of coastal marine waters.
- Mudflats are a predominant form of intertidal flats, found in sheltered environments in inlets and estuarine environments.
- Sandflats occur in areas with less mud in suspension and where sands are deposited by tides and currents.
- Found on gradually sloping to level shorelines.
- Submerged at high tide; exposed at low tide.
- Bottom type may be variable and patchy, ranging from areas of mud and sandy mud to sand, may also have some gravel.
- Develop in relatively sheltered waters, such as coves, shores of tidal rivers and the back of sand bars and in lagoons, or in areas of extreme high tides.
- Associated with beaches, salt marshes, sea cliffs and estuary shore zones.
- Typically do not support rooted vegetation, but may have salt marsh grasses at upper levels and seaweeds attached to exposed rocks and/or bedrock subtidally.
- Mudflats are replaced by coarser bottom types at their seaward extremities
- Productive areas with abundant life.

Where are intertidal flats found?

- In most sheltered bays, inlets and estuaries on shorelines of soft
- Sedimentary rock or where there is glacial till along the coast.
- Nova Scotia
  - Bras d'or Lakes
  - Northumberland Strait Shore
  - Bay of Fundy Coast
  - Annapolis Basin
  - Minas Basin
- New Brunswick
  - Bay of Fundy Coast
  - Gulf of St. Lawrence
  - Northumberland Strait Shore
- Newfoundland
  - Atlantic Coast
  - Gulf of St. Lawrence
- Prince Edward Island
  - Northumberland Strait Shore
  - Inlets and estuaries.

Figure 2.6. Sand flats with sand bars, Prince Edward Island.

Special Considerations:

- On the Nova Scotia and New Brunswick coasts of the Bay of Fundy, the especially high tides create more extensive mudflats than other areas.
- Intertidal flats in the southern Gulf of St. Lawrence and the Bay of Fundy have sediment transported by ice scour in winter.

Importance:

- Supports diverse fauna.
- Commercial and recreational harvest of clams and bloodworms.
- Major feeding grounds for adult and juvenile fish, waterbirds and waterfowl.
- Critical refueling stop for many shorebirds on their migration routes.

Key environmental Factors:

Physical factors

Substrate

- Fine sand to silt and clay; sand and gravel in tidal channels.
- Poor drainage, deprived of oxygen just a few centimeters below the sediment surface.
- Mud flats have a high water content and low load-bearing capacity.

Wave action

- Uppermost surficial sediment is mobile and affected by wind, tidal and longshore currents.
- Erosion during the winter from ice scouring and storms, deposition during the spring and summer.

Tidal Regime

- Surface of flat has sinuous tidal drainage channels.

Water-land interaction

- Existence of flats depends on sources of sediment; flats occur mainly in areas having nearby eroding coastlines.

Ice

- Picks up and removes sediment and organisms in winter and causes extensive scouring

Climate

- Extremes of water and air temperature and sediment surface in summer and winter, high humidity in summer, exposed to changes in salinity due to rain and estuarine waters.

Source Material

- Erosion of adjacent upland.
- Suspended sediment deposition from river or offshore sources.
- Sediment from other parts of flat.
- Suspended sediments deposited during high tide.

Turbidity:

- Very important in mud flats and sand flats in the inner Bay of Fundy.
- Turbidity reduces light penetration so most plant production takes place at low tide on the surface of the mud flat.

Temperature:

- Extremes of air and sediment temperatures in summer and winter; variations with tidal cycle.

Salinity:

- Precipitation lowers salinity. Salinity may change over a tidal cycle.

Biological factors

Vegetation

- Flats are too unstable for the growth of large plants and lack permanent rooted vegetation, except at high tidal levels.
- Microscopic algae (diatoms), filamentous algae and seaweeds (attached to stones). High productivity of microscopic algae (diatoms) living on/in the sediments.
- Bacteria is important in decomposition and as a food source.
- Salt marsh grasses and other species can colonize near the higher tide levels of mud and sand flats. Fragmented and decaying salt marsh plant detritus is an important food source for animals on the flats.
- Secretions and growth of mats of microscopic algae, bacteria and fungi on flats stabilizes the sediment.

Organisms

- Significant biological activity takes place while flats are submerged
- Clams, snails, crustaceans and worms feed on plankton, diatoms or organic matter and other animals in the flat.
- Several species of fish forage on the flats (i.e., flounders).
- Seabirds, shorebirds and coastal wildlife, feed on invertebrates (crustaceans, worms, etc.) in the flats.
- Animal and plant species are scattered throughout the flat although they may occur in clumps or patches. Generally live in the upper layers of sediment (15 cm).
- Seasonal changes in animal abundance in response to changes in primary productivity.
- Highest productivity is in summer. Some species survive the winter to repopulate the flat in summer.

Figure 2.7. Semipalmated sandpipers on Bay of Fundy mudflats.

Sensitivities:

- Biological communities in intertidal flats have adapted to resist short-term fluctuations in salinity and temperature.
- Critical periods: April - September when productivity is highest.
- Small localized flats would be more sensitive to disturbance than larger ones.
- Coastal changes that disrupt tides, currents and sediment transport can impact mudflat existence (e.g., due to the construction of a causeway, the Windsor, NS mudflat is entering the early stages of salt marsh development).
- Structures that are located in, or which cross a tidal body, may change tidal fluctuations and natural inputs of food and nutrients, prevent feeding by migratory fish and change ice conditions, all of which directly affect organisms.
- Stability and distribution of mudflats can be severely impacted by small changes in sea level.
- Stability of flats can be reduced by repeated activity (i.e., digging for baitworms contributes to sediment destabilization).

Key Issues and Importance:

- Fecal coliform contamination and other non-point sources of pollution from coastal urban development and agriculture can contaminate commercial and/or recreational clam beds to a point where harvest is prohibited by law.
- Coastal structures, such as causeways and tidal power barrages, alter currents and can affect mudflat stability.
- Mudflats in Atlantic Canada are the critical feeding areas for many migrating shorebirds.
- Major conservation areas for the protection of migratory birds in the region include mud and sandflats (i.e., the southern bight of the Minas Basin).

- Increased coastal tourism and use of mudflats needs planning to reduce impacts on these areas.
- Global warming leading to sea level rise will lead to changes in mud and sand flat distribution and extent.
- Human activity (e.g., clam, bloodworm harvesting, All Terrain Vehicles [ATVs]) disturbs flats.

Specific Land-Use Planning Considerations:

- Permanent or semi-permanent structures and activities on/or adjacent to a mudflat should not unreasonably interfere with the natural supply or movement of water or sediment within, to, or from the mudflat system, or unreasonably increase the erosion hazard to the mudflat.
- Planning should ensure that design of coastal structures, such as wharves and piers, outfall and intake locations and elevations considers short-term effects and seasonal shifts in mudflats as well as long-term changes (e.g., sea level rise).
- Depth of buried structures (e.g., pipelines) within a tidal flat should ensure that wave activity and tidal currents do not expose them.

Construction Considerations:

- Mudflats are delicate areas and any anthropomorphic activities can lead to significant damage. Working from a floating barge or floating pier rather than using gravity structures may minimize impacts of construction activities.
- The tidal cycle may constrain construction activities.
- Building structures of durable materials with long life, such as concrete pilings and rock gabions, may be preferable to use of wood.
- Consideration should be given to the impacts of ice, which can form on the flats and move against structures on the tides.

Salt Marshes

What are salt marshes?

- Salt marshes are grassy marshes that commonly occur on marine coasts of the Maritime Provinces.
- Transitional areas from the ocean to the land.
- Found on sheltered shorelines.
- Can be divided into regularly flooded 'low marsh' and irregularly flooded areas with salt hay—'high marsh'. Each type supports different animal and plant communities.
- A coastal ecosystem that has complex interactions between oceanographic, geological, chemical, hydrological and biological processes.
- Commonly grass-dominated, level areas with sinuous drainage channels and occasional deep pools (pannes).
- Higher elevations are influenced by land and freshwater inflow, while lower areas are influenced by marine tidal waters.
- Productive areas with abundant wildlife.
- Typically have mud or sand flats to the seaward edge.
- Form on stable or emerging coastlines where sediment accumulates.

Where are salt marshes found?

- Need sheltered areas with sediment.
- May form on the seacoast behind sandy barrier beaches and islands.
- Can develop on sandflats seeded by turf carried by ice.
- Nova Scotia
  - Atlantic Coast
  - Bay of Fundy
  - Eastern Shore
  - Southwestern Shore
- New Brunswick
  - Bay of Fundy Coast
  - Northumberland Strait Coast
- Newfoundland
  - Few selected areas
- Prince Edward Island
  - Gulf of St. Lawrence
  - Northumberland Strait

Figure 2.8. Salt marsh, Windsor, Nova Scotia, with mudflat in background

Special Considerations:

- Salt marsh distribution in New Brunswick and Nova Scotia has been reduced significantly by the development and maintenance of dykelands for agriculture.
- On the Nova Scotia and New Brunswick coasts of the Bay of Fundy, the especially high tides aid in the formation of salt marshes.
- Salt marshes in Newfoundland, the Gulf of St. Lawrence, Northumberland Strait and the Bay of Fundy have significant ice scour in the winter.
- Can vary in size from patches of a few metres across in some tidal rivers to hundreds of hectares.

Similar Environments

- Salt marshes can be sub-classified as estuarine marshes, high marsh, low marsh and coastal marshes.
- Salt marshes have different species of grass than those found on dune systems.

Importance:

- Nutrients brought into the marsh via tidal water become trapped in the marsh.
- Salt marshes have high value as wildlife habitat.
- Marsh vegetation fixes nitrogen from the atmosphere. Debris and roots from marsh vegetation create a rich organic soil—salt marsh peat.
- Rapid nutrient turnover.
- Fish spawning habitat and nursery area for larval and juvenile fishes.
- Detritus and plant material from the salt marsh is an important source of food in the coastal marine ecosystem.
- Important feeding, nesting and breeding areas for waterfowl.
- Can be used economically for salt hay.
- Salt marshes are one of the most productive ecosystems in the world.

Key Environmental Factors:

Physical factors

Sediments

- Fine silty and clayey homogenous sediments containing high levels of organic matter from decaying salt marsh plants (marsh peat).
- Tidal channels have coarse bottom, muddy sides and silt, mud and marsh peat among salt marsh plants.
- In areas where the coastline is predominately rocky, marsh development depends on silt brought to the coast by rivers.
- Sediment accumulation in salt marshes averages 2 to 10 mm per year in eastern North America.
- Sediment accumulation depends on tidal range, exchange and currents.
- Soils are wet and poorly drained.

Wave action

- Severe wave action can prevent the establishment of salt marsh grasses and/or erode existing growth.
- Erosion due to wave action is often sudden, involving removal of large amounts of marsh.
- Wave action is important in dispersing salt marsh seedlings.

Tidal Regime

- Sensitive to tidal range. Zonation of marsh types depends on tidal factors.
- Environmental changes (temperature, salinity), due to tidal stress, affect low marshes greater than high marshes.
- Higher marsh areas are removed from routine tidal currents and waves.

Water-land interaction

- Runoff from land and precipitation enters the marsh.

Ice

- Ice can transport plants and organisms, especially in low or intertidal marsh areas.
- Removal of marsh sod by ice can locally increase the rate of erosion.
- In waters having heavy ice conditions in winter (e.g., southern Gulf of St. Lawrence, Bay of Fundy) ice strips the lower marsh of vegetation.

Climate

- Broadly distributed from the tropics to the Arctic.
- Experience extremes in temperature. Cooler than land in summer, warmer in winter and generally high humidity.

Biological factors

Vegetation

- Salt marsh grasses account for most of the productivity and biomass of the marsh.
- Some plant production comes from algae growing on the mud and attached to salt marsh grasses.
- Other primary producers include phytoplankton, benthic algae and emergent vegetation.
- Plants in the low marsh are removed in the winter, grow in late spring and summer and decline in the fall. High marsh does not lose vegetation in winter.
- The presence of plants stabilizes the mud, leading the transition to the more organic rich soils common of the salt marsh.

Organisms

- Marine invertebrates (crustaceans, clams, worms, snails) live in and on the grasses and mud.
- Insects (beetles, flies), spider, mites, etc. live among salt marsh grasses.
- Fish, such as mummichogs and sticklebacks, are found in tidal channels and salt marsh ponds.
- Birds (shorebirds, waterfowl, songbirds, great blue herons, marsh hawks, eagles and osprey, etc.)
- Small mammals such as mice, muskrat and raccoon.

Sensitivities:

- Salt marsh communities can resist short-term fluctuation in salinity, temperature, humidity, desiccation and flooding.
- Critical periods are: May - September when productivity is highest.
- High marshes are more sensitive than low marshes to land-related factors, such as air temperature, snow, freshwater runoff and freshwater ice.
- Small, localized salt marshes are more sensitive than larger ones.
- Coastal changes that disrupt tides, currents and sediment transport can impact salt marsh development.
- Artificial disturbance (e.g., ditching or canals) can change the salt marsh succession.
- Destruction of salt marsh by dyking, dredging and infilling will affect plants and animals that depend on salt marsh habitat.
- Stability and distribution of salt marshes can be impacted by small changes in sea level, even those resulting from coastal construction.

Key Issues:

- Need for conservation.
- Agriculture (hay harvesting).
- Haying or use of recreational vehicles, such as ATVs, can alter the characteristics of the salt marsh.
- Coastal structures affect salt marsh development.
- Land-based activities, such as coastal development and deforestation, logging and agriculture, can enhance sediment supply to salt marshes and other coastal areas, burying or suffocating marsh vegetation.

Special Land-Use Planning Considerations:

- Salt marshes are extremely important habitats. Salt marshes should be zoned as special or protected areas.
- By restricting tidal flow in inlets, causeways lower tidal range and allow the high marsh in the inlet to extend further seaward. Removal of causeways has the reverse effect.

- Coastal projects somewhat removed from salt marshes may affect them. There is a need for comprehensive environmental assessment of proposed land use actions affecting salt marshes.

Coastal Structures:

- Structures that are in or cross a tidal body may change tidal fluctuations, flow regime and ice conditions, thus impacting the salt marsh.
- Minimize the footprint of any structures, such as bridge approaches on a salt marsh. Structures should allow free flow of water to the marsh and minimize shading.
- Working on salt marshes can lead to damage and consequent erosion. Approaches must be taken to minimize effect of activities.

Bedrock Shores

What is Bedrock?

- Basic material of which land masses are formed. Includes igneous, sedimentary and metamorphic rocks.
- Coastal features include rock cliffs, sloping rock faces and rock shelves and tables.
- Shoreline character and biological communities are dependent the bedrock's resistance to erosion.
- Resistant bedrocks—granite, quartzite, slate.
- Soft bedrocks—sandstone, siltstone, mudstone, gypsum, limestone, conglomerate, shale.

Where are Bedrock Shores found?

- Predominant coastline type throughout the Maritime Provinces.
- Resistant bedrocks—
  Nova Scotia: Northern and western Cape Breton, eastern shore to Cape Split, Northumberland Strait, Cape George.
  New Brunswick: Western Baie des Chaleurs.
- Soft bedrocks—
  Nova Scotia: Minas Basin, Chignecto Bay, Chedabucto Bay to northeastern Cape Breton.
  New Brunswick: Northumberland Strait to Central Baie del Chaleurs interspersed with Barrier islands and beaches.
  Prince Edward Island: interspersed with barrier islands, beaches and flats.
- Associated with boulder accumulations and pocket beaches.

Special Considerations:

- Intertidal zone—area between the highest high water to the lowest low water tide line.
- Subtidal zone—waters below lowest tide.
- Vertical zonation of organisms occurs within the intertidal and subtidal areas.
- Interaction between terrestrial and aquatic systems occurs in the high intertidal zone.
- Rock platforms form from submergence of exposed bedrock by rising sea levels or subsidence of the rock.

Importance:

- A productive area for seaweed and associated marine organisms.
- Rocks and boulders also promote seaweed growth and provide habitat and refuge for organisms.
- Principal areas for seaweed harvesting.
- Stable substrate for colonization of plants and animals.

Key environmental Factors:

Physical factors

Substrate

- Rocky with some sediment depending on area.
- Resistant bedrock that generally generates little sediment.
- Slope can vary from flat tables to steep cliffs.

Wave action

- Exposed to severe wave action.
- Main factor in rocky shore erosion.
- Wave action moves rocks and forces water into crevices at high pressure to crack bedrock.

Tidal Regime

- Intertidal range tends not to be as extensive as in depositional coastlines. coasts have extensive offshore bedrock.
- Also related to wind direction and storms (e.g., higher tides during onshore winds and during storms (storm surge).

Salinity

- Freshwater leads to reduced seaweed growth on bedrock shores in estuaries.
- Reduced salinity and sheltered conditions at the head of bays and inlets encourages ice formation.

Water-land interaction

- Erosion of bedrock and cliffs leads to development of boulder buildup in the intertidal zone.

Ice

- Freezing spray gets into the cracks/ crevices of rocks causing fracturing and/or erosion.
- Ice scouring of seaweeds and abrasion of rocks can occur, especially in the Gulf of St. Lawrence, Northumberland Strait and Western and Northeastern Cape Breton Island.

Climate

- Areas with ice buildup tend to be cooler year round and subject to harsher wind exposure. Ice-free areas are cooler in summer and warmer in winter.

Biological factors

- The kinds of animals and plants vary predictably with height relative to sea level (zonation).
- Types of invertebrate animals on bedrock shores exposed to the open ocean are the same as on sheltered ones, but the number of species is lower on the exposed shores because of reduced habitat diversity.
- Frequently have associated coastal barrens.
- Bedrock shores provide a stable substrate for colonization by seaweeds.
- Resistant bedrock allows more extensive colonization by seaweeds than softer bedrock.
- Tide pools form in bedrock depressions and provide a unique habitat for marine organisms.
- Wave action aids nutrient supply to seaweeds.

Exposed vs Protected

- A greater abundance and diversity of marine animals and seaweeds tends to occur in areas exposed to high wave energy than in sheltered areas. Ice conditions and higher environmental variability—warmer temperatures in summer, colder in winter, more variability in salinity, ice and siltation— in sheltered and estuarine environments tends to reduce the abundance and diversity of marine plants and animals there.
- Seaweeds, lichens and fungi; unicellular algal slimes, encrusting coralline algae.

Organisms

- Barnacles, carnivorous, herbivorous and ominivorous snails, mussels, seastars, crabs, amphipods and other crustaceans.
- Ravens, osprey, seabirds (e.g., cormorants), waterfowl.
- Grey and harbour seals nearshore.

Distribution

- Varying distribution of organisms within the intertidal zone and between different intertidal zones determined by slope/tidal range, topography, algal cover and predators.
- Water movement and ice conditions can control recruitment and distribution patterns in intertidal zones.

Sensitivities:

- Freshwater inflow and sewage locally—turbidity.
- Critical period area: May – October when productivity is highest.
- Winter storms and ice conditions.

Key Issues:

- Coastal hazard management.
- Management of scenic values (e.g., lighthouses) and coastal barrens.
- Seabird colonies, marine mammal haulout areas.

Special Land-Use Planning Considerations:

- Cliff erosion on soft bedrock shores. Dumping of materials on cliff edge to stabilize the slope.
- Potential for nesting and colonies of seabirds; marine mammal haulout areas.
- Adjacent waters available for ecotourism, diving excursions, etc.

Sand Beaches

What are Sand Beaches?

- Areas of sand exposed between extreme-high-tide and extreme low-tide marks.
- Areas of deposition of sand by waves, tides, currents and wind.
- Limited or no productivity by erect vascular plants.
- Dynamic area.
- Sand comes from offshore and/or longshore transport from nearby eroding coastlines.
- Three types of sand beaches:
  (1) Barrier beaches and spits: divide estuaries, lagoons and salt marshes from open marine waters.
  (2) Strandplain beaches: beaches directly backed by upland from which their sediment is derived.
  (3) Pocket beaches: small beaches of other major types, distinguished by being totally included in small bays.
- Unresistant rocks along the coast, such as soft sedimentary sandstone, can lead to development of sand deposits

Where are Sandy Beaches found?

- Nova Scotia
  - Atlantic Coast
  - Northumberland Strait
- New Brunswick
  - Baie des Chaleurs
  - North Shore
  - Northumberland Strait
- Newfoundland
  - Western Newfoundland
  - Heads of inlets
- Prince Edward Island
  - Predominately North Shore

Special Considerations:

- Sand builds up in summer, erodes in winter. Distribution based on storm activity.
- Beach face is steeper in winter.

Associated Environments:

- Above high tide level sand dunes may accumulate and are populated by beach grasses and a succession of species landward.

Figure 2.9. Sandy beach and dune system, Cavendish Beach, Prince Edward Island

Importance:

- Limited primary productivity.
- Limited vegetation except unicellular algae, which may live between sand grains in sandy environments.
- Sandbars and beaches provide protection from wave energy for land behind.

Key environmental Factors:

Physical factors

- Waves, tides, currents, ice and winds are the major physical forces that control the beach environment.

Substrate

- Fine to coarse sand mixed with gravel.
- Well-sorted deposits of sand composed primarily of quartz and feldspar.
- Gentle slope is generally a primary characteristic of the beach.

Wave action

- Longshore transport—waves move sand laterally along the beach.
- Affects the colonization, abundance and diversity of plants and animals.

Salinity

- Beaches often exposed to low salinity seepage due to groundwater and influx of rainwater.

Tidal Regime

- Tidal range and beach slope determines the extent of shore exposure.

Temperature

- Summer and winter temperature variations; daily variations due to tidal action.

Ice

- Ice rafting and buildup on beaches in Gulf of St. Lawrence and Northeast Cape Breton in winter.

Source Material

- Erosion of coastal, glacial or glaciofluvial deposits of sediment.
- Beach systems are in motion.
- Beaches migrate inland in the Maritimes as sea level rises.

Biological factors

Vegetation

- Diatoms and blue-green algae, but limited production.
- No leafy macrophytes, few if any vascular plants

Organisms

- Beach drift (e.g., seaweeds, eelgrass, jellyfish, subtidal animals) is a nutrient source for some animals and birds.
- Low abundance and diversity, increasing to adjacent subtidal areas.
- Bacteria and fungi.
- Invertebrates (amphipods, isopods)
- Seabirds (gulls, terns), shorebirds and land-associated birds.

Distribution

- Zonation within the sandy beach.
- Surf zones can sometimes have a high abundance of clam species adapted to turbulent conditions.

Sensitivities:

- In high energy environments, coastal construction, such as wharves, piers and boat launches can hinder the longshore transport of sand by trapping it nearby and leading to reductions in nearby beaches.
- Dune systems are sensitive to pedestrian and vehicle traffic.
- Important wildlife utilize beach areas (e.g., Piping Plover (a shorebird) nests on gravelly/sandy beach areas).

Key Issues:

- Recreation management.
- Often designated as conservation areas because of associated dunes and lagoon systems.
- Hazard areas due to unpredictable and catastrophic erosion.
- Coastal structures affect longshore surficial sediment drift.
- Residential development pressure.

Special Land-Use Planning Considerations:

- Beaches are often protected under legislation.
- Coastal structures can be used to trap sand and create beaches (e.g., groynes).

Boulder/Cobble Beaches

What are Boulder/Cobble Beaches?

- Coastal beach areas which consist predominantly of boulder to cobble-sized rocks (see Physical Factors below).
- Typically have a ridge or berm on the landward side.

Where are Boulder/Cobble Shores found?

- Limited to short stretches and predominantly in areas of bedrock and glacial till shore deposits.
- Throughout the Maritime Provinces, but predominantly Nova Scotia shores having resistant bedrock and glacial till/drumlin deposits.

Figure 2.10. Cobble beach and berm, Lockeport, Nova Scotia

Special Considerations:

- Generally stable but can be disturbed by extreme waves and related catastrophic events.
- Spaces between boulders provide shelter and sub-tidal seaweed can attach. Boulder beaches consist mostly of boulders derived from glacial till or from bedrock exposed to very high energy wave conditions.
- 'Storm beach' or berm forms on high-energy shores.

Associated Environments:

- Glacial till
- Bedrock shorelines
- Often have sandy portions or pockets.

Importance:

- Common coastal habitat of the Maritimes.
- Productive intertidal and subtidal zones are more resistant to wave energy than sand beaches.
- Beach berms may be sites for seabird colonies.

Key environmental Factors:

Physical factors

Substrate

- Boulder/cobble size particles from eroding bedrock or glacial till coasts.
- Boulders provide a relatively stable, hard substrate type, but are subject to movement in storms.
- Cobbles are more mobile and are redistributed readily.
- Cobbles are 6-30 cm in diameter, boulders are >30 cm.

Wave action

- High-energy wave action can move boulders and cobbles which abrades and removes intertidal plants.
- Presence of clean gravel generally indicates a high-energy environment.

Tidal Regime

- Creates zonation in animals and plants.

Water-land interaction

- Surface water, groundwater seepage and runoff can impact the shore.
- Boulder/cobble beaches are derived from coastal deposits and bedrock.

Ice

- Can scour rocks in winter and transport cobbles.
- Builds up at higher tidal levels often resulting in formation of a band of fixed ice (ice foot).

Salinity

- Distribution of plants and animals influenced by freshwater seepage.

Source Material

- Coastal, glacial, glaciofluvial or from bedrock.

Biological factors

Vegetation

- Rockweeds on the low intertidal; kelps and other seaweeds subtidally; encrusting coralline algae subtidal.
- Diversity of organisms and abundance may be comparable to bedrock shores.
- Lichens, fungi and flowering vascular plants above the high-tide mark.

Organisms

- Occur in the intertidal and subtidal.
- Barnacles, isopods, amphipods, periwinkles, green crabs, dog whelks, blue mussels, starfish and sea urchins.
- Debris and seaweed washed upon shore provides a habitat for amphipods and fly larvae.

Zonation

- Upper edges of beach zone or beach berm may have sand/gravel occupied by terrestrial communities including plant species, such as beach pea and cordgrass.
- Seasonal changes; most productivity in summer and highly reduced in winter.

Figure 2.11. Boulder beach, Guysborough County, Nova Scotia

Sensitivities:

- Placement of structures in the area may influence local currents and tidal influence to a degree that may change the degree of exposure.

Key Issues:

- Conservation areas; used for nature and recreation.
- Not ideal for coastal structures due to exposure.

Special Land-Use Planning Considerations:

- Cliff erosion on sedimentary shores.
- Dumping of materials on cliff edge to stabilize the slope.
- Potential for nesting and colonies of seabirds on berms.
- Adjacent waters available for ecotourism, diving excursions, etc.
- May function as haul out areas for marine mammals.

Sand Dunes

What are Dunes?

- Exposed shorelines that have one or more sand ridges in the back of the beach.
- Sand is transported by wind from the beach to the dune.
- Areas of deposition of sand above high tide.
- Unique grass communities stabilize the dunes.

Where are Sand Dunes found?

- Nova Scotia
  - Northumberland Strait.
  - Atlantic Coast
- New Brunswick
  - North shore
- Newfoundland
  - West coast
- Prince Edward Island
  - North shore

Special Considerations:

- Sand dune succession.
- Sand dunes can be legally protected.
- Fragile areas; management of sand dunes in recreation-beach development areas.
- Dunes often migrate landward.

Associated Environments:

- Sandy Beaches.

Importance:

- Productivity of dune grasses.
- Breeding areas for seabirds (e.g., gulls, terns), particularly on islands.
- Protect terrestrial ecosystems landward of the dunes.

Key environmental Factors:

Physical factors

Substrate

- Fine to coarse sand.
- Low nutrient levels.
- Ridges and depressions.

Wave action

- Storms can add/remove sand to a beach and increase/decrease dune development; major storms can breach sand dunes.

Tidal Regime

- Generally separated from tidal influence.

Wind

- Acts to build dunes and modify shape of the dunes.

Water-land interaction

- Storms affect beach deposition.
- Sand removed in winter, restored in summer.

Climate

- Create protective microclimate; warmer in summer and sheltered in winter

Source Material

- Beach sands, derived originally from coastal erosion.

Figure 2.12. Sand dune and beach

Biological factors

Vegetation

- Varies with the stage of succession.
- Grass, heath plants, lichens, etc.
- Dune grass and dune plants and shrubs (e.g., Beach pea, Wild Rose).
- Cranberry shrubs to alders in the depressions of dunes in the later stages of succession.
- Organic debris, such as seaweed, washed up on the adjacent beach may provide a major nutrient source.

Organisms

- Terrestrial amphipods, beetles, flies, spiders.
- Snails and slugs, as well as vertebrates (snakes and mammals), in later stages of dune succession.
- Seabirds (e.g., gulls, terns); terrestrial birds (ravens); song birds (sparrows).

Sensitivities:

- Dunes can be destroyed by damage to dune grasses.
- Fragile ecosystem.

Special Land Use Planning Considerations:

- Relative importance of different dune systems.
- Consider importance of dunes in coastal protection.
- Threat to dunes from development and public use for recreation.
- Effects on dunes of coastal activities, such as dredging and construction on sand transport to beaches and associated sand dunes.
- Extremely fragile ecosystem to any anthropogenic influence.
- Sand dunes can be legally protected.

Coastal Structures:

- Snow fences and other measures help to trap sand and stabilize dunes.
- Board walks and platforms as access points to adjacent beaches.

Lagoons/Barachois

What Are Lagoons/Barachois?

- Barachois and lagoons are shallow, fully marine to estuarine water bodies between the coast and offshore sand or cobble beach/barrier island chain.
- Common along eroding coasts where wave activity moves significant quantities of sediment along the coast and in high energy coastal environments where storms push sand and gravel onshore.

Where Are Lagoons/Barachois Found?

- *Nova Scotia*—Northumberland Strait shore, St. Georges Bay, minor inlets on rocky coasts, Eastern Shore and South Shore of Nova Scotia.
- *New Brunswick*—North shore from Baie des Chaleurs to Northumberland Strait, outer Bay of Fundy coast.
- *Prince Edward Island*—predominantly west, north and eastern coasts.
- *Newfoundland*—Common on west coast and occasionally in isolated inlets throughout the province.

Special Considerations:

- Barrier island/lagoon systems on the north shore of New Brunswick and in Prince Edward Island are the most extensive in Canada.

Similar Environments:

- Sheltered estuaries.

Importance:

- Lagoons and barachois contain productive terrestrial and marine ecosystems.

Key Environmental Factors:

Physical Factors

Substrate

- Mud, organic matter (roots and detritus) and exposed sand and gravel form a surface layer over deeper sediments, such as sand, gravel and bedrock.
- Storms that breach the protective barrier ridge or island may bring sand, gravel and flotsam (nets, lobster traps) and deposit them in lagoons.

Wave Action

- The waters of the lagoon are protected from waves and winds.

Tidal Regime

- Lagoons may be tidal with periodic exchange through a narrow channel. Freshwater inflow to the lagoons can create varying degrees of estuarine conditions.

Water-land Interaction

- Terrestrial vegetation occurs in close proximity to the lagoon shore.
- Erosion is reduced, but periodic breaching of the barrier islands/bars can cause catastrophic damage to terrestrial features.

Ice

- Lagoons typically freeze in winter, but are protected from the scour of offshore ice.

Climate

- Lagoons have less severe extremes of temperature and wind but maybe locally hotter and more humid.

Source Material

- From the adjacent coast, sand and gravel bars and islands – all of which help form the lagoon.

Biological Factors

Vegetation

- Salt marsh vegetation develops subtidally and colonizes the shorelines of lagoons and eelgrass (*Zostera marina*). Various species of common coastal algae, such as rockweed (*Fucus* spp.), can develop if the salinity is high enough.

Organisms

- Diverse community of invertebrate animals and fish in lagoons. Small fish, such as sticklebacks and mummichogs, may dominate. Lagoons open to the ocean may have juvenile stages of coastal fish species, such as herring and flounder, providing there is sufficient salinity.
- Seabirds (terns, gulls), shorebirds (sandpipers, plovers), raptors (osprey, eagles) may feed on organisms found in lagoons.
- Terrestrial animals such as raccoon, fox and coyote may also feed in lagoon areas.
- Waterfowl (loons, ducks and geese) commonly occur.

Sensitivities:

- Lagoons/barachois have restricted water exchange and cannot sustain loadings of sewage, nutrients and sediment.
- Southern Gulf of St. Lawrence lagoons have several warm water seaweed species that are unique to the area.

Key Issues And Importance:

- Lagoon ecosystems are very sensitive to coastal development, in particular through addition of nutrients and sediments and through uncontrolled human activity.
- Anthropogenic development in the vicinity of lagoons and other coastal areas are subject to periodic severe storm damage.

Special Land-Use Planning Considerations:

- Lagoons and associated environments, such as a salt marshs and dunes, offer recreational opportunities (e.g., trails, lookoffs).
- Productive habitats that should not be filled in to allow for development.
- Proximity to high-energy seacoast may preclude residential development due to erosion hazard.

Inlets and Estuaries

What Are Inlets And Estuaries?

- There is no basic definition to distinguish an inlet from larger coastal features, such as bays and sounds.
- Inlets are semi-sheltered coastal water bodies extending inland from the open coast. In the Maritime provinces, most inlets have formed as rising sea level filled pre-existing river valleys along the coast and many still have watercourses entering at their heads.
- Freshwater inflow into inlets reduces salinity and creates characteristic patterns of water currents and productivity. The majority of inlets in the Maritimes are estuaries to varying degrees.

Where Are Inlets/Estuaries Found?

- All coastal areas of the Maritime Provinces.
- The size and character of inlets depends on the topography—in coastal lowlands, inlets can extend significant distances inland.
- Estuaries occur in the heads of inlets and extend from the river or stream mouths significant distances along the inlet, sometimes to the open ocean.
- Estuaries include shoreward zones where freshwater floats on the seawater and extends seaward into areas where the surface water becomes increasingly saline through mixing with the seawater.
- In inlets where the freshwater inflow is limited, the freshwater and seawater mix immediately, creating reduced salinity from top to bottom of the water column and extending seaward.

FACT SHEET

Special Considerations:

- Inlets are generally sheltered from storm and wave activity of the open ocean, but can have parts that are exposed to waves and currents generated by storm events.
- Generally the rate of coastal erosion is less in an inlet than along an adjacent exposed coast.
- Inlets tend to be the most highly populated and industrialized regions on the coast. As a result they often have severe problems of coastal contamination and disruption of wildlife. Special care should be taken in developing and managing coastal environments in these areas.
- Aquaculture operations for both finfish and shellfish are frequently located in inlets. Development of coastal lands should aim to minimize impacts on water quality, especially for parameters, such as coliform bacteria, that significantly affect shellfish aquaculture.

Importance:

- Inlets tend to be important for terrestrial and marine wildlife and a lengthy coastline provides areas for nesting and foraging for avian wildlife, such as eagles.
- Various fish species that use coastal rivers for spawning (e.g., Atlantic salmon) or for development (e.g., eels which enter rivers as juveniles and grow to maturity there) pass through inlets enroute to the rivers.
- During summer feeding and over-wintering periods inlets support finfish, such as gaspereau and smelt, and invertebrates, such as crab.

- Many of the invertebrate and finfish species in inlets are commercially important and some are fished recreationally.
- Estuaries are some of the most productive marine environments because the dynamic interaction of the freshwater flow with seawater brings nutrients to the surface, contributing to increased marine algal productivity.
- Estuaries, and inlets in general, frequently have warmer water than nearby coastal areas, and are used as nursery areas for many marine benthic and pelagic species.

Key Environmental Factors:

Physical Factors

Substrate

- Underwater sediments in inlets depend on the character of the geological formations of the coastline and the current, tide and wave activity. Smaller inlets tend to be shallower and have significant tidal movement, leading to more coarse sandy to gravelly bottoms. Deeper inlets tend to have coarse bottoms in the intertidal and immediate subtidal zone, grading to muddy bottom below.

Wave Action

- Inlets are more sheltered than open coastal environments.
- Large inlets (e.g., Halifax Inlet, Sydney Harbour) can have significant wave energy generated by winds blowing down or across the inlet.
- Coastal inlets, such as the Miramichi River estuary in New Brunswick, are large and shallow enough to result in significant wave activity and resultant erosion.

Tidal Regime

- The incoming and outgoing tides generate strong currents in coastal inlets, often sufficient to cause scour of the seabed and the restriction of marine activities.

Water-land Interaction

- Rising sea level is leading to gradual erosion of the coastline in inlets in many areas of the Maritimes.

Ice

- Inlets tend to freeze in winter.
- Shorefast ice can develop in inlets and shores suffer ice damage daily through the action of tides and during the departure of the ice in the spring.

Climate

- Inlets tend to be sheltered from extreme climatic conditions.

Biological Factors

- Various coastal types and associated biological organisms occur in inlets, including: rocky shores, sandy beaches, gravel/cobble beaches, mud flats, salt marshes, lagoons and islands.

Vegetation

- Abundance of seaweeds increases seaward.
- Seaweed growth is limited in inlets by the reduced level of wave and current action.
- Due to 'brown water' of acidic streams reducing the amount of light available to plants, many inlets in the Maritime provinces have reduced growth of seaweeds.

Organisms

- Many marine fish species can tolerate the reduced salinity found at the head of estauries.
- If the salinity has not been markedly reduced by freshwater, the sea bottom is inhabited by common marine invertebrates, such as

crustaceans, including crab and lobsters, worms, seastars, clams, mussels, oysters and many others.

- Various species of wildlife use the coastline of inlets and most species common to outer coastal areas may be found in inlets from time to time.

Sensitivities:

- Due to circulation patterns, which tend to retain contaminants, estuaries and inlets are more sensitive to inputs of contaminants, such as sewage.
- Some seaweeds, such as rockweed (*Fucus* spp.), can tolerate reduced salinity and can occur in portions of inlets having periodically reduced salinity.
- Effects of watershed activities (agriculture, forestry, industry, urban infrastructure, non-point source pollution).
- Aquaculture versus residential development in coastal inlets.
- Invasive species (i.e., Green Crab).

Special Land-Use Planning Considerations:

- Inlets are subject to increasing residential and recreational development (e.g., wharves and marinas).
- Multiple uses of inlets makes planning difficult.
- How to balance development with consideration of ecosystems.

Key Issues:

- Contamination from coastal development and urbanization.

Dykes and Dykelands

What are dykelands?

- Agricultural lands developed from salt marshes and separated from the marine environment by dykes.
- Man-made systems with drainage ditches and one-way gates (aboiteaux) enable the dykelands to drain.

Where are Dykelands Found?

- Mainly in the Bay of Fundy in Nova Scotia and New Brunswick. Most tidal rivers of the Bay of Fundy have associated dykelands.

Special Considerations:

- Dykelands support water-associated birds at various times of the year, including eagles, osprey and shorebirds.
- Dykelands exist only because of protection by dykes that are continuously maintained by marshland authorities in the provincial governments of New Brunswick and Nova Scotia.
- Most dykelands are cropped for hay or used for livestock grazing.
- Dykelands have a risk of flooding through extreme tides and storm surges. In particular, the threat of sea-level rise through global warming is a concern in management of dykelands.
- Dykelands occasionally return to salt marsh when dykes are breached and owners choose not to have them rebuilt.

Importance:

- Idle dykelands have the potential to become wetlands for wildlife habitat.
- Dykelands are located among diverse habitats encompassing salt marshes, mudflats, estuaries and open coastal environments and are used by a large variety of wildlife.
- Dykelands have become important landscape features in many areas.
- The shoreline of dykes typically develops fringing mudflats and salt marshes.

Figure 2.13. Bay of Fundy dyke

Key Environmental Factors:

Physical Factors

Sediments

- Soils in dykelands are typically moderately to well-drained silt.
- Muddy deposits occur on the seaward side of dykes.
- Tidal rivers adjacent to dykes typically have bottoms composed of coarse material, such as gravel and rock, and sediment becomes finer up the slope of the dyke.

Ice

- Heavy ice build-up occurs on shorelines of channels bordered by dykes.
- Ice can block drainage from dykelands in winter causing flooding.
- Ice from rivers bordered by dykes' moves downstream during thaws and

forms major accumulations on tidal flats.

Salinity

- Dykeland channels are predominately freshwater environments that occasionally may have estuarine characteristics due to leaking aboiteaux.

Tides and Currents

- Mudflats and fringing marshes may develop and protect the dyke from erosion.
- The dyke protects dykeland from tides and currents.

Temperature

- Shoreline environments along the dyke experience significant fluctuations in temperature, both seasonally and daily through the tidal cycle.

Waves

- Wave conditions are most severe on exposed coasts and generally dykes withstand most severe impacts at high tide.
- Tidal rivers bordered by dykes are generally sheltered from wind and wave action.

Biological Factors

Vegetation

- Salt marsh vegetation develops on the outer slope of dykes.
- Dykeland vegetation is predominantly agricultural crops (ie. hay).
- Commonly freshwater marshes will develop on dykelands where they abut an adjacent upland.
- Biological communities common to both salt marsh and mudflat (see fact sheets on intertidal flats and salt marsh) can border the dykes.

Animals

- Dykeland drainage channels and ditches may have resident populations of small estuarine and freshwater fish and crustaceans.
- Some dykelands have major rivers passing through them providing habitat for migratory fish populations (e.g., Atlantic salmon), and therefore require special aboiteaux and management to allow fish passage.
- Dykelands on the open coast may have extensive mudflats on the seaward side.
- Coast-associated species of birds, such as eagles and osprey, gulls and shorebirds, waterfowl, as well as terrestrial birds such as marsh hawks, ravens, crows, songbirds, are commonly found in the vicinity of dykelands.
- During high tide periods, feeding shorebirds may roost (gather) on dykeland.
- Some fauna and flora common to mudflats and salt marshes may be found on the banks of dykes.

Sensitivities:

- Dykeland ecosystems are robust and less sensitive under natural conditions.
- If hay is cut too early, the reproductive success of many of the bird and animal species may be reduced. Normally farmers are advised to wait until July before cutting.
- The existence of dykelands depends on continued management and maintenance of the dykes and water control structures, as well as proper stewardship of the land within. Shifts in the public view of the importance of agriculture could lead to reductions in resources dedicated to dykeland maintenance and loss or alteration of dykeland systems.
- Sea level rise as a result of global warming could result in the need of

additional expenditures for dyke maintenance.

Land-Use Planning Issues:

- The historic loss of salt marsh habitat to dykeland and other coastal activities is a major concern. Allowing some idle dykelands to revert to salt marsh by discontinuing dyke maintenance or consciously removing of dykes has taken place, but large-scale restoration is unlikely.
- Due to the potential for flooding, dykeland is considered to be a coastal hazard and development for uses other than agriculture and resource-based industries should be avoided. A Nova Scotia municipality recently adopted a dykelands by-law that restricts use of dykelands.
- Where the dykes are located adjacent to population centres, they can be used for the development of walking trails.

3. COMPENDIUM OF TOOLS AND INSTRUMENTS FOR LAND USE PLANNING IN THE COASTAL ZONE

3.1 LAND USE PLANNING TOOLS

Various techniques and approaches are available to land use planners for dealing with coastal land development. In particular, techniques that deal with environmental management are required, including approaches for protecting the coast from coastal hazards and unplanned multiple use. This guide is aimed at improving the ability of land use planners to deal with environmental issues in coastal areas, including sustainable development and developmental impacts on marine, coastal and estuarine resources.

In general, approaches to planning in coastal areas in Canada are at an early stage in development. Activity and efforts in developing a framework for planning are not as far advanced as in the United States, where coastal zone management has been legislated for almost three decades, and the European Union, which has formalized approaches to management of coastal areas. The recent adoption of the *Oceans Act*, with its focus on managing activities in estuarine, coastal and marine areas in an integrated and sustainable manner, is among many current initiatives to improve management of resources in Canada's coastal zone.

The management principles and approaches contained in the *Oceans Act* should be incorporated in land use planning activities in or affecting coastal and marine areas. Planning approaches in the coastal zone should incorporate elements of sustainable development—the goal of insuring that our present activities are carried out in the manner that does not jeopardize the opportunities for future generations to benefit from the environment. Where

there is lack of knowledge or doubt about the effects of a development measure or initiative, planning should also adopt precautionary attitudes. This approach should err on the side of caution to minimize damage to the environment. Similarly, planning should occur within the broader context of integrated oceans and coastal management through collaborative and inclusive planning, advisory and decision making processes. All area-based planning should be consistent with and support ecosystem approaches to the management of estuarine, coastal and marine areas.

Coastal or Shoreline Buffer Zones/Setbacks

Coastal or shoreline buffers are a widely-used planning and management tool to separate land- based anthropogenic activities from coasts, control damage from coastal hazards and protect the aquatic environment of both freshwater and marine coastal ecosystems.

Overview

- Coastal buffer zones extend typically up to between 30 m and 500 m from shore and are meant to control human activities in the immediate coastal area.
- Coastal buffers, recognized in bylaws or legislation, are an important land-use planning tool.
- As well as providing a means for coastal land-use management, a coastal buffer zone entrenches, promotes and fosters recognition of the importance of coastal areas, resources and features.
- Coastal buffers reduce impacts of activities on other human uses and minimize impacts on natural environments.
- Vegetated buffers prevent or slow coastal erosion.
- Buffers can help retain property values.
- Coastal buffers can reduce or limit property loss from coastal hazards (e.g., shoreline erosion, storms, storm surges and floods).
- Coastal buffers help preserve scenic and tourism values.

Principles

- No human activity permitted within the defined buffer area.
- Buffers should be used to allow both human and natural uses of the coastal environment to coexist; buffers can be a tool in implementing an integrated resource management approach in a coastal area.
- Outcomes of implementing buffers in some cases can be uncertain. Any use of buffers should include provision of a time frame for review to allow for change (adaptive management).
- Where possible, buffers should be optimized to protect the local ecosystems.
- Since past practice may dictate a wide range of buffers and setbacks, seek the largest practical buffer/setback.
- Where buffer guidelines are not legislated, planners can legally impose buffer restrictions by incorporating them as terms and conditions for approval for various activities.
- In some cases setbacks can be used to separate a conflicting coastal activity from other uses.

Types of Buffers

Development Buffers

- Provides visual and physical separation of heavy use activities, such as industry from both natural and human environments (e.g., residential areas).

Conservation Buffers

- Minimize interactions between built environments and natural environments having special status (e.g., conservation areas), resource use (e.g., fishing grounds), sensitive environments (e.g., dune systems) or those that fill critical environmental functions (e.g., salt marsh or estuary).

Vegetated Buffers

- Reduce runoff and consequent erosion of low-lying shorelines and cliffs.
- Control microclimate (e.g., break wind, moderate temperature).
- Separate light use activities (e.g., residential, agricultural) from natural environments.

Vegetated Buffers for Construction and Work-Sites

- Natural buffers protect high quality wetlands, waterbodies and coastal areas.
- Environmental sustainability of coastal regions depends on the management of adjacent landscapes, which includes upland areas.
- Native vegetation can be used to establish buffers along wetlands, stream edges and coastal shores, known as riparian zones.
- Native plant material should be protected during construction.
- Replant buffer strips using native vegetation indigenous to the riparian zone.
- Avoid applying fertilizers or pesticides once the buffer is established.
- Provide maintenance to control weeds and maintain native plant diversity.
- If vegetated buffers must be constructed or reconstructed, native vegetation has advantages over conventional engineering solutions used to stabilize eroding streambanks and shorelines (e.g., riprap or steel pilings, etc.) and enhances aquatic habitat and aesthetics. There are many vegetation management techniques available for construction in coastal areas.

Figure 3.1. Vegetated buffers for construction and work sites

Current Practice

Many coastal provinces and states use a combination of buffer zones and setbacks in coastal land-use management. Many examples are from the United States experience. No uniform standards exist, however, and criteria for buffers vary considerably. The use of buffers and the existence of guidelines are much more common in relation to freshwater shorelines, including lakes and rivers. In several cases, we have included buffer guidelines that relate to freshwater coasts as a guide to what might be possible for marine coasts.

New Brunswick

- The recently adopted "A Coastal Areas Protection Policy for New Brunswick" has adopted a coastal management approach based on coastal sensitivity to the impact of developments, as the Government recognizes the critical importance of coastal areas.
- This Policy separates coastal lands into three areas: core (Zone A); buffer (Zone B); and transition (Zone C). The core area is described as the most sensitive zone. Beaches, dunes, rock platforms, coastal marshes, and dyked lands that are found between the Higher High Water Large Tide (HHWLT) and the Lower Low Water Large Tide (LLWLT) are considered to be within core area. The buffer area is the area 30 m landward of the inland edge of the core area. Zone C, the transition area, is to extend

from the landward edge of the buffer zone to a distance not yet decided. This distance will be decided at a later date.

- Activities within each area, or zone, will be permitted based upon their impact to the coast (Figure 3.2. and 3.3.). The most development restrictions are within the core area. Acceptable activities are outlined within the Policy.

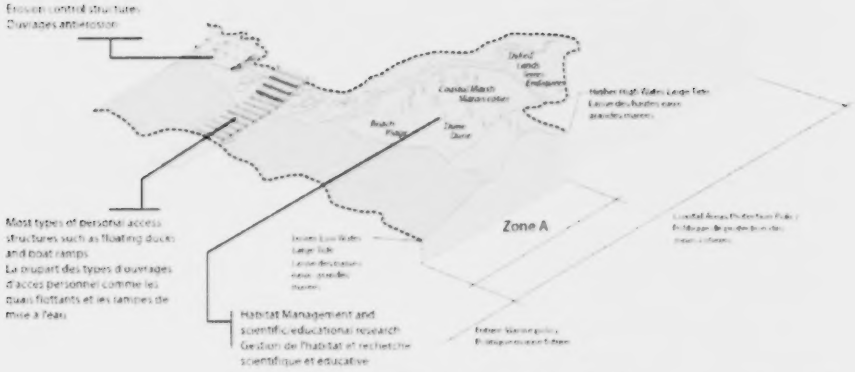
Prince Edward Island

Prince Edward Island has various coastal buffers under several pieces of legislation, presented in Table 3.1.

Nova Scotia

- Buffer zones and setbacks are not legislated, although they are widely used in practice for controlling activities adjacent to freshwaters (lakes, rivers, streams and wetlands).
- A municipality may use its zoning powers to impose setback requirements and buffer zones for coastal wetlands, and to regulate permitted uses near environmentally sensitive coastal habitat.
- Many municipalities have 8–16 m (25–50') watercourse setback restrictions with the amount increasing to 30–90 m (100–300') for agricultural operations.

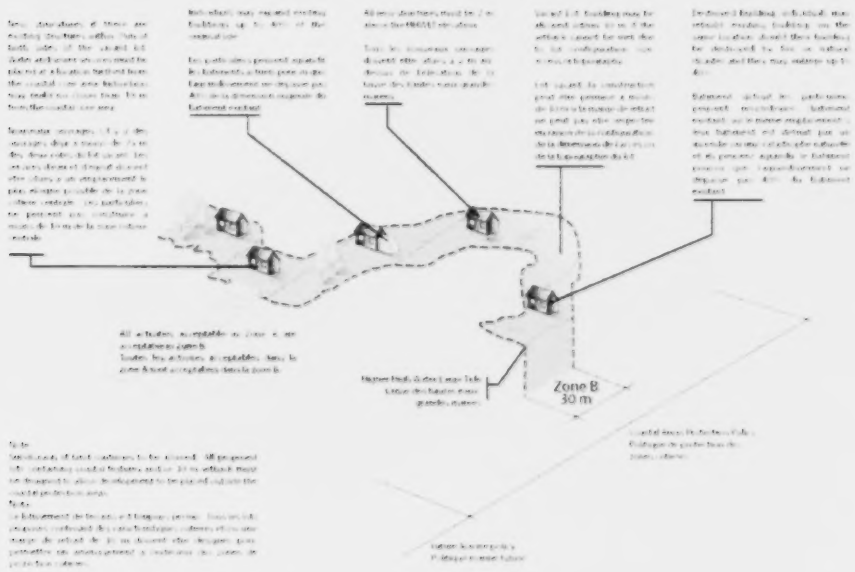
Acceptable Activities in Zone A
Activités acceptables dans la zone A


Most types of personal access structures such as floating docks and boat ramps
La plupart des types d'ouvrages d'accès personnel comme les quais flottants et les rampes de mise à l'eau
Habitat Management and scientific/educational research
Gestion de l'habitat et recherche scientifique et éducative
Zone A

(New Brunswick Department of the Environment and Local Government, 2002)

Figure 3.2. Acceptable activities in zone A

Acceptable Activities in Zone B
Activités acceptables dans la zone B



(New Brunswick Department of the Environment and Local Government, 2002)

Figure 3.3. Acceptable activities in zone B

Table 3.1. Coastal Buffer Zones in Prince Edward Island

Coastal Buffer Zones in Prince Edward Island		
Legislation and Coastal Type	MINIMUM BUFFER WIDTH[2]	SETBACK[3]
Planning Act—Subdivision Development Regulations (subdivision development inside the 'coastal area'[1])		
Natural Buffer Zone[2]		
Beach	18.3 m or 60 times the annual erosion rate. Measured from top of bank adjacent to beach.	
Watercourse or Wetland	18.3 m Measured from mean high water mark or the edge of the wetland.	
Primary or Secondary Sand Dune	18.3 m Measured from inland boundary of dune.	
Setbacks for Buildings and Structures[2,3]		
Beach		22.9 m or 60 times the annual rate of erosion, whichever is greater. Measured from the nearest exterior portion of a building or structure to the top of the bank.
Watercourse or Wetland		22.9 m Measured from the nearest exterior portion of a building or structure to the inland boundary of the wetland or watercourse.
Primary or Secondary Sand Dune		30 m Measured from the nearest exterior portion of a building or structure to the inland boundary of the dune.
Environmental Protection Act		
Comprehensive Watercourse Buffer Zone[4]		
Forested Riparian Zone	20-30 m depending on slope. Measured from the edge of a wetland or watercourse.	
Intensive Livestock Zone		
New Operations and Construction	90 m. Measured from the edge of a wetland or watercourse.	
Existing Operations and Facilities	20-30 m depending on slope. Measured from the edge of a wetland or watercourse.	
Non-forested Land Zone[5]		
Crop Production[6]	10 m Measured from the edge of a watercourse or wetland.	
Development	10 m Measured from the edge of a watercourse or wetland.	

1. Coastal Area is the zone within 500 m of the mean high water mark and extends to 500 m seaward of the mean high water mark.
2. As a condition of subdivision approval, the Minister may require greater buffer or setback widths to protect a beach, wetland or watercourse.
3. Structures include any construction that is fixed to or sunk into land or water, excluding structures on federal lands and certain structures used for fishing and boating.
4. Comprehensive watercourse buffer zones apply in all inland and coastal areas excepting land-locked ponds, man-made ponds without permanently flowing outlet, the perimeter waters of PEI, drainage ditches and intermittent streams and springs. Uses within these zones are restricted.
5. This zone applies to agricultural land under crop production and land under development.
6. Does not include forage crops, which are included in the Intensive Livestock Zone.

New Hampshire

- *Tidal buffer zones* are allocated to upland areas within 30 m (100') measured on a perpendicular to the highest observable tide line. Tidal buffer zones include developed and undeveloped areas. Projects in relation to potential impact to these zones are categorized in terms of: *major* projects (projects in undeveloped tidal buffer zones); *minor* projects (projects in developed tidal buffer zones within 15 m (50') of salt marsh vegetation); and *minimum* projects (any project in a developed tidal zone that is more than 15 m (50') from a salt marsh).
- In New Hampshire, any construction activity, subdivision or site development should include a detailed site management plan that includes planned use and a detailed description of buffers.
- Primary buildings can be built 15 m (50') from public waters and accessory buildings 7 m (20') from public waters.
- In New Hampshire, a 83 m (250') shoreline zone is designated for managing coastal activities. For example, salt storage yards, junk yards, solid waste and hazardous waste facilities cannot be located within this zone.
- No fertilizer can be used within 8 m (25') of the shoreline of any property; other uses within these areas may require permits; and stumps and their root systems must remain intact in ground within 15 m (50') of a reference line, which is the highest observable tide (TABLE 3.2).
- In conservation areas (coastal areas designated for special protection) the width of shoreline buffers is set at the average height of the canopy in the natural climax forest in the area.

Maine

- Maine has shoreline buffers that encompass freshwater, tidal and coastal areas.
- Maine municipalities must show that proposed subdivisions within 83 m (250') of any wetland or associated shoreline will not adversely affect the water or shoreline quality. In special coastal areas (e.g., shoreline areas of rivers that have been designated as having outstanding scenic, historic or conservation significance), a proposed subdivision plan must allow for the primary structures to have a combined shoreline frontage and setback of 167 m (500') from the normal high-water mark.
- In proposed subdivisions, structures must also be constructed with the lowest floor level at least one foot above the 100 year flood elevation.
- In defined protected areas, a natural buffer strip must be maintained between the working edge of an excavation and a coastal wetland. A natural buffer strip is at least 25 m (75') wide (measured from the upland edge of a coastal wetland).
- Maine State has 'restricted use land zones' where a minimum buffer width of 133 m (400') is required from the bounds of any watercourse
- New structures must be set back a minimum of 41 m (125') from the normal high water line with vegetation between the watercourse and structure.
- Maine shoreland areas are areas within 83 m (250') of the normal high-water line of any great pond, lake, river or saltwater body, within 83 m (250') of the upland edge of a freshwater wetland or within 25 m (75') of the highwater line of a stream. Within these areas the minimum buffer width should be 8 m (25'). Buffers of 17–33 m (50–100')

should be established for larger and/or more sensitive streams, wetlands and coastal areas.

Washington State

- Agricultural land use guidelines require local governments to promote the maintenance of a permanent vegetation buffer zone at a minimum 17 m (50'). A description of vegetation/management buffer zones should be included in local coastal master plans for areas between tilled land and nearby water bodies.

Table 3.2 Shoreline buffers and setbacks from New Hampshire—shoreline protection standards

Shoreline buffers and setbacks from New Hampshire Shoreline Protection Standards.		
Categories	Applicability	Distance within shoreline (m)
Prohibited Uses	Establishment/expansion of salt storage yards, auto junk yards, solid waste and hazardous waste facilities.	80
	Use of low phosphate, slow release nitrogen fertilizer	
Uses Requiring Permits	Public water supply and existing solid waste facilities	
	Public water and sewage treatment facilities	
	Public utility lines	
Restricted Uses	All new lots are subject to subdivision approval by the Department of Environmental Services.	
	Setback requirements for new septic systems and lot size is based on sediment characteristics.	
	Permit needed for altering land areas of 50,000 square feet or more.	
	Number of residential units is dependent on on-site sewage and septic systems; residential area is not to exceed 1 unit per 150 feet of shoreline frontage.	
Natural Woodland Buffer Restrictions	Where existing, a natural woodland buffer must be maintained.	50
	Tree cutting is limited to 50% of the basal area of trees, and 50% of the total number of saplings in a 20 year period; a well-distributed healthy stand of trees, saplings, shrubs and ground cover must be maintained.	
	Stumps and their root systems must remain intact in the ground within 50 feet from the reference line*.	
	Clearing for building construction is limited to 25 feet outward from building, septic system and driveway.	
	Clearing for accessory structures is limited to 10 feet outward	
New Septic Leachfield Setbacks	125 feet where soil down gradient of leachfield is porous sand and gravel.	40
	100 feet where soil maps indicate presence of soils with restrictive layers within 18 inches of natural soil surface.	30
	75 feet where soil maps indicate presence of all other soil types.	25
	75 feet minimum setback from rivers.	
Primary Building Line	Structure setback 50 feet from the reference line*.	20
	Fertilizer use is prohibited within 25 feet of reference line*.	10
	Accessory structure setback of 20 feet from the reference line*.	5
*Note: the reference line for coastal waters is the highest observable tide line and for rivers is the ordinary high water mark.		

Coastal Classification

Coastal classification is an important process which involves categorizing or grouping coastal areas into classes or types based on common characteristics. Classification simplifies decision-making regarding coastal and other environments by allowing them to be more readily assessed and compared. Classification can complement zoning where different land-use options depend on the type of coastal environment.

Overview

- Coastal areas can be classified into types based on conservation, resource and use criteria for coastal management purposes. Coastal classification includes shoreline typing and inventory; designations recognizing special status, such as parks or protected areas and wildlife management areas; and designations based on use or activity type.
- Classification of coastal areas based on biophysical, resource, conservation and use criteria has been done for most coastal areas in the Maritimes and can aid in land-use planning.
- Classification promotes increased awareness of special features and needs resulting from designating the environments.
- Classification also can impact local planning by affecting national policies, programs and regulations, etc.
- Shoreline classifications and inventories are done on a local basis and are developed on an area-wide basis to aid management at various levels. These inventories should be done by provincial governments because they can more readily coordinate efforts between municipalities, organizations and the federal government. Funding for inventories should be coordinated with other efforts to avoid duplication and enhance coordination.

Principles

- Planning activities and in particular, zoning, should incorporate coastal classification systems.
- Coastal environments have different importances, sensitivities and features, which should be recognized in any planning activity.

Types of Classifications

Biophysical

Coastal environments can be classified into types based on a range of factors including exposure, slope, coastal geology and biological aspects (See Section 2, Coastal Environments and Ecosystems of the Maritime Provinces). Classification of coastal environments have been prepared for various purposes, from oil spill response to coastal zone management, which can be used to assist planners.

Floodplains
Mud flats
Sand flats
Beach/Dune Systems
Wetlands
Coastal Islands
Lagoons/Barachois
Dykelands
Eroding coastlines
Coastal cliffs

Figure 3.4. Coastal types

Landscape
Landscape approaches focus on distinctive features of the coastal environment, such as the geomorphology (e.g., the European Community divides coastal landscapes into cliffed and rocky coasts; and coastal plains). In the European Union (EU) definition of cliffed and rocky coasts, the underlying geological structures are fairly resistant to erosional forces, such as the sea, rain and wind, and can occur in high and low relief areas. Steep cliffs, rocky outcrops and deep marine waters characterize high relief areas. Beaches and dunes may be present in these low relief areas, but they are rarely extensive. Coastal plains, on the other hand, are mainly low relief areas with a wealth of sediment eroded from soft rock cliffs and/or sediment supplied from intertidal sand/mud flats, salt marshes and dunes.

Land-use
Land-use is commonly classified in terms of the types of activities it supports. For example, the Canada Land Inventory (CLI) mapped present land-use using a generalized land-use classification system that integrated land cover and activity. It also classified the land for its capability to support agriculture, forestry, recreation and wildlife. There was also a map done on sport fishing. These were based on biophysical attributes of the landscape.

Nova Scotia has developed an activity-based land-use classification system. The system, which is based on activity in an area rather than by ownership, considers land cover (natural vegetation), type of product and ownership; uses a coding system; and is flexible and adaptive to changes and additions.

Classifications include—*Agriculture, Fishery, Forestry, In transition, Manufacturing, Mining, Protected and Limited Use, Recreation, Culture and Entertainment, Residential, Sales, Service and Transportation, Transmission and Storage*. For example, the "Protected and Limited Use" category includes bird sanctuaries, historic sites (national and provincial), parks (national and provincial), protected beaches, reserves, and wildlife management areas (national and provincial).

Figure 3.5. Activity-based land use classification system – Nova Scotia

Coastal Types Designated under Various Legislation

Beaches (Nova Scotia)—an area of land on the coastline lying seaward of the mean high water mark. The Nova Scotia *Beaches Act* identifies important beaches and designates specific beaches, dune systems and other sensitive habitats for special protection. Removal of sand, gravel, stone or other material from a beach without permission of the Minister of Environment is prohibited and permission is needed prior to the construction of a path, trail or road on a beach; to building a structure; to having or using a vehicle on a beach; and to riding or walking a horse on a beach.

Special Places (Nova Scotia)—Nova Scotia's *Special Places Protection Act* allows areas of particular significance to be designated as special places. This usually protects the sites from future development and can include coastal areas.

Migratory Bird Sanctuaries (Canada)—Protected areas including coastal environments under the *Migratory Birds Convention Act*. Chiefly restricts hunting.

National Wildlife Areas/Protected Marine Areas (Canada)— Protected areas, including coastal areas, under the *Canada Wildlife Act*. National Wildlife Areas occur on land and in coastal waters within the 12 km Territorial Sea; Protected Marine Areas occur beyond the Territorial Sea. Purposes for designation by the Canadian Wildlife Service include wildlife conservation, research and public education.

Marine Protected Areas (MPA) (Canada)—Protected areas in estuarine, coastal and marine waters under Canada's *Oceans Act*. Purposes for designation by Fisheries and Oceans Canada include the conservation and protection of commercial and non-commercial fishery resources (including marine mammals) and their habitats, endangered or threatened marine species and their habitats, unique habitats and marine areas of high biodiversity or biological productivity.

National Marine Conservation Areas (NMCA) (Canada)—Protected areas consisting of submerged lands and waters within the internal waters, Territorial Sea or Exclusive Economic Zone and any coastal lands or islands within Canada. NMCAs are designated by Parks Canada for the purpose of protecting and conserving representative marine areas in support of Canada's natural and cultural marine heritage.

Protected Habitats (Massachusetts)—Includes salt marshes, shellfish beds, dunes, beaches, barrier beaches, salt ponds, eelgrass beds and freshwater wetlands.

Coastal Barrier Systems (Maine)—Coastal barriers act as natural protective buffers from damage due to storms and provide habitats for migratory birds and other wildlife. Under the Coastal Barrier Resources Act of 1982, all coastal barriers must be identified and should be protected and conserved.

Shoreland Areas (Maine)— Areas within 250 feet of the normal high-water line of any great pond (lake), river or saltwater body; within 250 feet of the upland edge of a coastal wetland; within 250 feet of the upland edge of a freshwater wetland except as otherwise provided; or within 75 feet of the high-water line of a stream.

Submerged Lands (Maine)—all land from the mean low-water mark or a maximum of 550 m (1,650 feet) seaward of the mean high-water mark.

A coastal classification system developed for land use planning in New Brunswick included a mix of types. Coastal types identified in New Brunswick coastal management were: beaches, dunes, salt marshes, dyked lands, intertidal areas, cultural heritage features and environmentally significant areas.

From: Draft New Brunswick Land Use Policy for Coastal Lands (1999)

Figure 3.6. New Brunswick coastal types

Non-Point Source Pollution

Non-point source (NPS) pollution is a major source of contaminants to the marine environment in coastal areas. An understanding of NPS pollution can assist in land use planning by influencing choice of options for policies and coastal management measures. Properly managed NPS pollution can reduce contamination of waterways and coastal areas and aid in maintaining natural habitats and ecosystem processes.

Overview

- NPS pollution refers to contaminants that enter the environment as the result of everyday activities from numerous small sources. It is contrasted with the pollution from large readily identified sources, such as sewage plant outfalls and industrial smokestacks. Contamination from land-based activities enters through runoff or infiltrated groundwater. Some examples include:

- Sewage from poorly maintained septic systems.
- Dust and siltation from erosion during construction activities.
- Salt from ice control on roads and snow dumping.
- Siltation from forestry activities and agriculture, pesticides from golf courses and urban park lawns.
- Docks, moorings and marinas.
- Oil from automobile traffic, roads and parking lots.
- Marine vessel activities.
- Agricultural runoff (coliform bacteria, pesticides, herbicides).

Principles

- Coastal management and planning should acknowledge NPS pollution as an element of any human activity and include it in setting standards, policy and other administrated decisions. Planning programs, particularly public outreach and education, should include components dealing with, and means to limit the impact of non-point source pollution on the coastal environment.
- NPS pollution degrades water quality and habitats, and generally interferes with ecosystem processes. Long-term cumulative effects, as well short-term immediate effects on the environment, need to be considered in planning decisions in the coastal zone.

Currently shellfish harvesting is prohibited in 37% of the surveyed areas in the Maritimes due to non-point source pollution, principally fecal coliforms from urban activities and agriculture. This has a direct, negative economic impact—affecting employment, tourism and aquaculture development.

Information for Public Education Approaches for Typical Non-point Sources in Coastal Areas (New Hampshire Department of Environmental Services)

Septic Systems

- Inspect yearly and pump out if the sludge and surface scum are one-third of the depth of tank.
- Do not flush bulky items, toxic materials, food waste or grease.
- Repair leaking fixtures to reduce the amount of water your system handles.
- Use environmentally friendly cleaning products.

Road Construction

- Minimize or avoid constructing roads near sensitive areas (wetlands, lakes, streams, mudflats and coastal marshes).
- Avoid building roads up and down steep slopes; instead follow the contours of the land.
- Stabilize a site with seeding, mulching, silt fence, hay bales, etc. as soon as possible during and after construction.
- Schedule activities during times of little rainfall.
- Minimize the amount of bare soil exposed.
- Construct and install stable outlets for all ditches and stormwater sewer systems before building the ditches and pipe outlets.
- Direct runoff away from construction areas and stormwater channels until proper stabilization has been achieved.
- Protect existing stormwater inlets and culverts from sediment by using sediment traps, silt fences, hay bales or perforated risers.
- Minimize the length of road per unit area and the number of watercourse crossings, especially in sensitive areas.
- Avoid wet seasons prone to severe erosion or spawning periods for fish.

Road Salting and Snow Dumping

- Storage sites should be located away from surface water and covered to prevent runoff.
- Salt applicators should be made aware of sensitive areas (e.g., public water supplies).
- Disposed snow should be stored near flowing surface waters, but at least 25 feet (8 m) from the high water mark of surface waters or the coast.
- A silt fence should be placed between snow storage area and high water mark.
- The snow storage areas should be 75 feet (25 m) or more from any private water supply wells, 200 feet (60m) from community water supply wells, and 400 feet (120m) from municipal wells.

Site Excavation and Development

- Retain natural vegetation where possible.
- Minimize the duration of bare soil exposure.
- Prevent erosion by mulching or providing other cover where possible.
- If possible divert clean runoff around disturbed areas.
- Minimize slope lengths and provide immediate erosion control measures (matting).
- Monitor the effectiveness of mitigation and adjust, maintain and repair periodically and after every storm.

Gravel Excavation

- Allow space for mild pit slopes (no greater than 2 to 1), diversions and adjacent owner protection.
- Assess the impact on nearby drinking water wells.
- Store petroleum products outside the pit area and provide an above-ground containment area if petroleum storage is essential in the pit.
- Have a spill prevention plan that all employees are aware of and trained in. Report and clean-up spills immediately.
- Maintain and wash equipment outside of the pit.
- Control dust.
- Use retention basins to trap fine material.
- Have natural buffer strips between the pit and surface water.

Agriculture

- Apply pesticides only when needed and store and handle pesticides properly.
- Do no apply pesticides on windy days or before a heavy rainfall.
- Plant crops along contour lines.
- Rotate crops.
- Maintain filter strips between fields and surface waters.
- Control runoff via stabilized diversions.
- Restrict livestock from streambanks or sensitive areas.
- Avoid spreading manure or fertilizer on frozen or snow covered ground.

Urban Runoff

- Vegetation should be used extensively to filter runoff.
- Divert runoff around sites where pollutants could be picked up.
- Keep parking areas, outdoor storage areas and streets clean of debris; maintain catch basins and other flow control devices.

Chemical and Petroleum Storage

- Keep an up-to date material inventory.
- Have periodic inspections for leaks or other problems.
- Have a spill prevention and response plan.
- Store containers in areas that will contain leaks.

Timber Harvesting

- Erosion control guidelines are available for woods and road construction.
- Divert water from exposed soils through road ditching, culverts, and drainage management techniques for distances of 50 feet (15m) or more.
- Include filter strips (wider on steep slopes) between exposed soils and waterbodies (slopes of 0-10 degrees).

Docks, Moorings and Marinas

- Use phosphate-free detergents and treat wash water before it is discharged into a waterbody.
- Periodic out-of-water engine maintenance for boats.
- Use propylene glycol instead of ethylene glycol antifreeze.
- Painting, scraping, sandblasting, etc. should be done out of the water and containment devices should be used.
- Install containment booms at fueling stations and install catch basins around boat launches to prevent pollutants from entering the water.

- Provide pumpout facilities to eliminate potential wastewater discharges into waterbodies.

A Planning Approach to Controlling Non-Point Source Pollution:

1) Prevent pollutant loadings via planning, design, and education (most effective, less maintenance, and more cost effective in the long-term)
2) Treat unavoidable loadings.
3) Control non-point source pollution during three stages (siting and design, construction, and post-development)

Figure 3.7. Information for public education approaches for typical non-point sources in coastal areas

Table 3.3. Planning and management tools for non-point source pollution

	Applicability to Water Resource Protection	Land Use Practice	Legal Considerations	Administrative Requirements
General Approaches				
Water Quality Monitoring	Used to monitor water quality within critical areas.	Communities establish water quality monitoring programs for critical areas. Communities require developers to monitor water quality down gradient from their developments.	Accepted method of ensuring water quality.	Requires moderate administrative staffing to ensure routine sampling and response if sampling indicates contamination.
Contingency Plans	Used to ensure appropriate response in cases of contaminant release or other emergencies.	Community prepares a contingency plan involves wide range of municipal/county officials.	None.	Requires significant up-front planning to anticipate and be prepared for emergencies.
Hazardous Waste Collection	Used to reduce accumulation of hazardous materials within critical areas and the community at large.	Communities, in cooperation with the state, regional planning commission, or other entity, sponsor a "hazardous waste collection day" several times per year.	There are several legal issues raised by the collection, transport and disposal of hazardous waste.	Hazardous waste collection programs are generally sponsored by government agencies, but administered by a private contractor. May be expensive.
Septic and Chemical Regulations				
Underground Storage Tanks (USTs)	Used to prohibit and regulate USTs within critical areas.	Community adopts special permit or performance standards for use of USTs within critical areas.	Well accepted regulatory option for local government.	Regulating USTs requires moderate amounts of administrative support for inspection follow-up and enforcement.
Privately-Owned Small Sewage Treatment Plants (SSTPs)	Used to prohibit SSTPs within critical areas.	Community adopts health/zoning ordinance prohibiting SSTPs within critical areas. Community adopts special permit or performance standards for use of SSTPs within critical areas.	Well accepted regulatory option for local government.	Prohibition of SSTPs requires little administrative support. Regulating SSTPs requires moderate amount of administrative support for inspection follow-up and enforcement.
Septic Cleaner Ban	Used to prohibit the application of certain solvent septic cleaners (known water contaminants).	Community adopts health/zoning ordinance prohibiting the use of septic cleaners containing 1,1,1-Trichloroethane or other hazardous solvent compounds.	Well accepted method of protecting surface and ground water quality.	Difficult regulation to enforce even with sufficient administrative support.

Septic System Upgrades	Used to require periodic inspection and upgrading of septic systems.	Community adopts health/zoning ordinance requiring inspection and, if necessary, upgrading of septic systems on a time basis (e.g., every 2 years) or upon title/property transfer.	Well accepted purview of government to ensure protection of surface and ground water.	Significant administrative resources required for this option to be successful.
Toxic and Hazardous Materials Handling Regulations	Used to ensure proper handling and disposal of toxic materials/ waste.	Community adopts health/zoning ordinance requiring registration and inspection of all businesses using toxic/hazardous materials above certain quantities.	Well accepted purview of government to ensure protection of surface and ground water	Requires administrative support and on-site inspections.

Source: Washington State, Department of Ecology

Some NPS pollution impacts can be reduced at the construction stage by requiring appropriate development plans, which include a NPS pollution management.

Purpose

To have environmental planning for stormwater management which integrates site design and stormwater quality management into one process. If watershed policies are not supported by an environmentally responsible design at the subdivision and site level, then stormwater management may fail.

Stormwater Management Objectives

- to reproduce the pre-development hydrological conditions;
- to confine development and construction activities to the least critical areas of the site and consider cluster development to minimize land disturbance;
- to maintain the overall desired density of development by allocating higher densities to areas most suitable for development; and
- to minimize changes to the existing topography; and preserve and utilize the natural drainage system.

Stormwater Management Guidelines

- all lands with slopes of 15% or greater should not be developed unless additional environmental control measures are implemented to minimize the amount of erosion generated from the site;
- all wetlands (as defined by the presence of characteristic wetland vegetation) should be excluded from development;
- all shorelines should be protected by a 100 foot buffer zone within which no vegetation or soil should be removed or altered. The width of the buffer zone may be decreased to 75 feet if, through detailed study, the topography and vegetation conditions warrant the reduction;
- all wetlands and watercourses should be protected with a buffer strip within which no vegetation or soil should be removed or altered. For wetlands, the buffer strip should be at least 25 feet in width for wetlands less than 0.5 acres in size and 50 feet for wetlands over 0.5 acres. All streams shall have a minimum 50 foot buffer strip on each side;
- the amount of impermeable surfaces created should not exceed 25% of the gross area of the proposed development. Minor increases in this figure may be considered provided the amount of proposed undisturbed land substantially exceeds the guideline and such undisturbed lands are incorporated into the final drainage plan;
- a minimum of 25% of the natural vegetation on the site should be retained in an undisturbed state and incorporated into the final drainage plan;
- the amount of phosphorous entering Morris Lake through stormwater generated on the site should be reduced by approximately 40% through the use of stormwater best management practices; and no development shall be permitted on septic systems; and
- as part of the stormwater design, erosion control should be a priority.

From: Morris-Russell Lake Development, Plan. With permission from Griffiths Muecke Associates, Halifax, NS.

Figure 3.8. Example of an erosion management design from a Nova Scotia subdivision development plan

Public Involvement

Community involvement and public education are important tools in coastal planning. Many land-use issues may be best approached using planning approaches that involve or educate the public. Community involvement gives property owners an opportunity for input into management decisions regarding land-use, improves communication and increases environmental awareness of agencies, governments, non-government organizations and the community.

Principles

- In addition to being affected by land-use planning, the public is a source of knowledge and energy that can be used to improve the effectiveness of planning.
- Activities undertaken in a sustainable manner will benefit both communities and their economies in the long-term.

Community Involvement

- Some approaches to land use management involve stewardship of undeveloped lands by landowners or co-management with governments or conservation organizations. A planner may achieve planning objectives by making landowners aware of options.
- Economic incentives can encourage community members to become involved in managing their properties and surrounding areas in a sustainable manner. For example, sound environmental management of an area will aid in retaining property values.
- Non-governmental organizations and local public authorities (e.g., watershed management groups, regional conservation councils) are increasingly active in assuming a role in environmental issues and should be included in planning processes.

Public Education

- Used to inform community residents of the connection between land use within watersheds and surface and groundwater quality.
- Planners can employ a variety of public education techniques ranging from brochures detailing watershed protection programs to seminars and events, such as hazardous waste collection days.
- No outstanding legal considerations are involved in public education.
- Public education requires some degree of administrative support for programs, ranging from modest support for brochure mailing to more intensive support for seminars and hazardous waste collection days.
- Public education is a proactive approach, which will carry through from one generation to the next. It is also cost effective, as long-term costs are cheaper than short-term reactive or "clean-up" measures.
- Mechanisms to inform the public of changes to formal planning strategies and land use bylaws.

Table 3.4. Approaches to community involvement in land management

	Applicability to Water Resource Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Land Acquisition/Donation	Land acquired by a community, either by purchase or donation. Provides broad protection to surface and groundwater.	Communities generally work in partnership with non-profit land conservation organizations.	There are many legal consequences of purchasing or accepting donations of land from the private sector, mostly involving liability.	There are few administrative requirements involved in purchasing or accepting donations of land. Administrative requirements for maintenance of land donated or purchased may be substantial, particularly if the community does not have a program for open space maintenance. Purchase may be expensive.
Municipal Planning Strategies, Land-Use Bylaws Reviews	Ability to zone for conservation, require setbacks, etc.	Municipal initiative, often using representative Steering Committees.	Does not bind federal, provincial governments; does not force municipality to implement capital projects. Existing uses are grandfathered.	Development permitting and enforcement mechanisms already in place.
Conservation Easements	Can be used to limit development within critical areas.	Similar to acquisitions, conservation easements are generally obtained with the assistance of non-profit land conservation organizations.	An easement is a legally-binding agreement requiring the easement acceptor to enforce the easement.	Monitoring and enforcement of easements are required but are usually not major administrative concerns.
Land Banking	Used to acquire and protect land within critical areas.	Land banks are usually accomplished with a transfer tax established by government (in the United States) empowering local government to impose a tax on the transfer of land from one party to another.	Land banks can be subject to legal challenge as an unjust tax, but have been accepted as a legitimate method of raising revenue for resource protection.	Land banks require significant administrative support if they are to function effectively.
Watershed Organization/ Conservation	Used to oversee environmental issues and affect policies and actions.	Involved in all aspects of watershed management and education.	Can be legal entities and enter into memoranda of understanding with government levels, individuals and organizations.	Require modest in kind support (Labour and Facilities) for activities.

Source: Washington State, Department of Ecology

1) Education applies to all residents in the entire Morris Lake Watershed.
2) Information programs for land owners on buffer zone management and the use of fertilizers.
3) Educational programs for local schools.
4) Encourage local property owners to have special 'clean-up' days for litter.

Morris-Russell Lake Development Plan.
With permission from Griffiths Muecke Associates, Halifax, NS.

Figure 3.9. Example of a public education plan included in a Nova Scotia subdivision development plan

FACT SHEET

Coastal Land-use Planning and Canadian Law

Legal and statutory tools provide standards for land-use practices; define and clarify institutional conditions; and express land-use concepts as plans and management actions. All levels of government— local, provincial and national— have a particular involvement with these planning controls.

Overview

- Under the Canadian constitution, regulation of land-use in Canada is largely the responsibility of the provincial governments. All provincial legislatures have statutes providing for the creation of plans to guide development, establishment of policies for particular planning concerns and allotment of powers for land use management.
- In cases where land use activities impact on aquatic and marine environments, federally legislated requirements for environmental assessments, ecosystem protection, resource conservation and public access must be met (e.g., protection of fisheries habitat, regulation of pollutants). Key federal legislation includes the *Fisheries Act*, *the Navigable Waters Protection Act*, the *Canadian Environmental Protection Act* and the *Canadian Environmental Assessment Act*.
- Provincial land-use planning statutes are generally designed to involve local authorities, to provide for public input and to allow for review by government agencies.
- Administration of land-use planning, including the power to make decisions on the current and long-range use of land, is generally assigned to local authorities.
- Local public authorities are increasingly active in assuming a role in protecting the environment and in some provinces they have an increased ability to engage in environmental planning.
- Municipal governments have at their disposal a limited range of powers that may be used for environmental regulation and management. Municipalities may restrict development by designating an area as environmentally sensitive.
- Provincial statutes, such as planning acts or municipal acts, are usually implemented by ministries or departments responsible for municipal affairs.
- Statutes pertain to specific geographic areas or planning functions. For example, specific legislation may address subjects, such as transportation, significant physical features, building permits and construction standards.
- The provincial governments maintain control through an appeal process and through their supervisory roles.

Principles

- Planning activities done in an integrated and sustainable manner will benefit both communities and their economies in the long-term.
- The legal and statutory framework should recognize both the interconnectedness of human concerns and the needs of the natural environment, ensure the long-term survival of both and minimize adverse effects of land-use practices on the environment.

Municipal and Local Levels

- Municipalities influence the use of land by using a range of tools including policy, official plans, zoning by-laws, subdivision control, site plan control, demolition control, expropriation powers, highway/road extensions and improvements, municipal land ownership and development charges.

Examples of legal and statutory instruments at the municipal and local level.

- "*Municipal Planning Strategies*" or "*Official Plan*", which are prepared by a municipality with public input, set principles and policies concerning the nature, pattern, extent and scheduling of future growth and change within the municipality for a specified period of time. Larger municipalities may have a further hierarchy of planning documents, consisting of secondary or neighbourhood plans and zoning by-laws. Some rural municipalities do not have an Official Plan and must rely on established provisions of the province's Planning Act and/or Municipal Act. Development proposals and environmental considerations are normally considered at the subdivision and/or site plan stage. Local environmental considerations would typically be addressed at this level.

Municipal Policy Objectives

-Housing
-Industrial and commercial development
-Health
-Transportation
-Environmental protection
-Economic development
-Aggregate (gravel) extraction
-Heritage preservation
-Parks
-Recreation
-Municipal finance
-Public participation
-Agriculture
-Floodplain protection
-Management of environmentally sensitive areas
-Land severance and subdivision
-Utilities
-Shoreline and water body protection

Provincial Policy Objectives

-Septic tanks/fields
-Groundwater
-Inland waterways
-Highways, trucks and buses
-Shortline railways

Federal Policy Objectives

-Ports and airports
-Coastguard and navy
-Mainline railways
-Trans Canada highway system
-Environmental/resource protection
-Freshwater and marine fish habitats

Figure 3.10. Topic areas for Municipal, Provincial and Federal Policy objectives

- *Policy* is an important wide-ranging tool that can be used to influence activities in municipalities. Policy is important in decision-making involving both the public and private sector. The development of any successful land-use policy, coastal zone

included, requires extensive and prolonged public consultation. Policies are only effective when the majority of citizens agree with their intent.

- *Land-Use (Zoning) Bylaws* are legal documents passed by a municipal council in accordance with a Municipality's official plan and must conform to the plan's stated purposes and intention. Zoning bylaws are typically specific in their provisions, restricting the kinds and intensity of development, as well as regulating the use of land and many other aspects of site building configuration (e.g., density, height, bulk, setback, buffers, parking, etc.). Only in limited circumstances (e.g., flooding, marshy areas) can zoning bylaws be used to prevent development. Municipalities without official plans generally do not have zoning bylaws and must rely on provincial statutes to regulate land-use.

Typical Coastal Planning Policies and Appropriate Management Techniques

Erosion Control

1) regulate development suitability at sites (through education programs and permits).
2) insure proper location in relation to shoreline (setback, education programs).
3) build coast protection structures at appropriate locations (master plan).
4) regulate private construction of groynes, revetments (permit).
5) limit construction in erosion prone areas (no-build zones).

Habitat Protection

1) regulate location/use of development activities relative to valued habitats (education, permit, special area management).
2) regulate discharges from development which may affect habitats (permit, education).
3) reduce resource use conflicts (special area management).

Coastal Pollution

1) regulate effluent discharge of new development activities (permit).

Coastal hazard management

1) the ability of natural features such as beaches, sand dunes, coastal infrastructure, wetlands and barrier islands, to protect use, should be recognized and maintained and, where appropriate, steps should be required to enhance that ability (education, master plan).
2) planning, development and use in coastal areas, should recognize that natural features may migrate inland as the result of dynamic coastal processes (including sea-level rise).(policy statements, plans and education).

Sri Lankan Coastal Management Strategy. From Kay and Alder (1999).

Figure 3.11. Typical coastal planning policies and appropriate management techniques

- *Environmental Management and Regulation* at the local level usually falls in categories of: Nuisance; Environmentally sensitive areas; Business licensing and regulation; and Public health. Environmental concerns also can be dealt with under zoning controls. The environmental regulation and management role that can be played by local public authorities is determined by the provincial government legislation that delegates powers to municipalities.

Provincial Level

Provincial environmental legislation is an important consideration in land-use planning. The level of environmental protection is not the same in each province. Generally, environmental legislation focuses on the discharge of contaminants into the environment by requiri[illegible]censes and permits and by invoking penalties for unacceptable discharge, but laws c[illegible]late:

- -Env[illegible]tal impact assessment
- -Waste management
- -Land conservation
- -Transportation
- -Mining
- -Drinkable water standards
- -Agriculture

Provincial governments also issue general policy statements or statements of interest that must be taken into account in municipal planning decisions. Provinces can set out several statements of interest that outline areas in which the provincial government has declared a specific interest. Usually provincial laws require that planning decisions have regard to such provincial statements.

Some Provincial Policy Statements or Provincial Statements of Interest relating to:

- -Infrastructure
- -Water quality and quantity
- -Cultural heritage
- -Natural Heritage
- -Natural hazards (e.g., floodplains)
- -Archaeological resources

Figure 3.12. Provincial policy statements

The BC Local Government Statutes Amendment Act provides for including environmental considerations in the planning process:

- Official Plans must include policies relating to the "preservation, protection, restoration and enhancement of the natural environment, its ecosystems and biological diversity.
- Development permit areas must be designated for the purpose of protecting the "natural environment, its ecosystems and biological diversity".
- Local governments must require developers to provide information on anticipated impacts of a proposed development or activities.
- Local governments must pass bylaws requiring landowners who construct paved areas or buildings having significant roof areas, to manage and provide for ongoing disposal of surface run-off and stormwater, and to impose limits on the maximum percentage of a parcel that can be covered by impermeable material.
- Local governments must provide powers of property tax exemption for a portion of riparian (shoreline) land if it is under a conservation covenant granted to that local government.

British Columbia Local Government Statutes Amendment Act (1998)

Figure 3.13. Legal instruments for environmental planning in British Columbia

Zoning

Zoning is one of the most important planning and management tools for land-use planners in the coastal zone.

Overview

- Land use zoning can be used to spatially separate uses and control incompatible uses; to integrate complex and often complicated management objectives; and for ecological, conservation and protected area management. Zoning is usually implemented through zoning bylaws. Related tools include time partitioning, facility/infrastructure restrictions, permit/license quotas and production quotas. Zoning can be based on ecological, social and economic values.
- Zoning bylaws regulate the use of land and many other aspects of site building configuration (e.g., density, height, bulk, setback, buffers, parking, etc.).
- Bylaws are adopted in accordance with the municipality's official plan and must conform to the plan's stated purposes and intention.
- Municipalities without official plans generally do not have zoning bylaws and must rely on provincial statutes to regulate land-use.
- A zoning bylaw is usually very specific in its provisions and only in limited circumstances can zoning bylaws can be used to prevent development from taking place. Bylaws restrict the kinds and intensity of development.
- Bylaws can also regulate shoreline protection, tree cutting, flood prevention, drainage, watercourse alteration and soil removal.
- Municipalities may restrict development indirectly by designating areas as environmentally sensitive (e.g., conservation land and open space designations).

Principles

- Zoning should be as simple as possible with the number of zones kept at a minimum in order to encourage public understanding and support. Complex zoning may lead to decreased public support.
- Development goals need to be balanced with precautionary, protection and conservation measures to maintain the ecosystem integrity of coastal areas.
- Undeveloped areas, which contain fragile or distinctive natural resources, should be given special status that ensures their protection.

Open Space Zoning—Undeveloped Coastal Areas

- A zoning approach where various small, clustered lots are surrounded by protected fields and/or woodlands.
- Used to protect open space or to conserve rural character.
- An alternative approach to conventional zoning.

General:

- Successfully implemented in several municipalities in New England and the mid-Atlantic states, as well as in various counties in Virginia, Washington State and California.
- New construction is located on a portion (half) of the lot, while the rest of the lot becomes permanently protected under a conservation easement.
- Lots and roads will not cover more than 50% of the parcel and therefore, at least 50% of the area will be open space.
- Open space areas provide recreation areas.
- Based on the "cluster" technique (to group homes onto part of the development lot while the remainder of the area is preserved as un-built open space).
- Cluster lots should be separated from adjacent farmland/woodland by a buffer strip of 75-100 feet.

Open Space Zoning (clustering)

- Same overall amount of land as development for conventional zoning.
- 50% of land is developed and 50% of land is preserved as open space.
- Down-sized house-lots reduce the costs of building roads, water and sewer lines as well as reduce the cost of residential snowplowing and related taxes.

vs.

Conventional Zoning

- Development designation as for each acre of land.
- Land-consumptive process.

R. Arendt, Planning Commissioners Journal

Figure 3.14. Open space zoning—undeveloped coastal areas

State of Maine Approach to Coastal Zoning

Growth Areas: Areas suitable for residential, commercial and industrial development.

Rural Areas: Agricultural, forest, open space and scenic lands.

Watershed Districts: Zoning to protect, restore and maintain the natural functions and values of coastal wetlands; freshwater wetlands; rivers, streams and great ponds (lakes); coastal harbours; bays; estuaries and marine water; and to manage and conserve the land and water resources of watersheds.

Submerged Lands: All land from the mean low-water mark to a maximum of 500 m (1,650 feet) seaward of the mean high-water mark.

Fishing and Maritime Activity: Within shoreland areas a municipality may adopt zoning ordinances establishing a commercial fishing and maritime activity zone. Zoning should consider the number of commercial fishermen and use of the shoreland area; availability of the shoreland area for commercial fishing; demand for shoreland property for commercial and residential purposes not related to commercial fishing or maritime activity; access to the shore; and availability of space appropriate for commercial fishing and maritime activities.

Coastal Barriers: The State of Maine designates coastal barriers as part of the coastal barrier system. No funding may be expended for projects on coastal barriers, including: construction; purchase of any structure or related infrastructure; for roads, airports, and boat landings or other facility on, or for bridges or causeways to, any coastal barrier; or for any project to prevent erosion of, or stabilize any inlet, shoreline or inshore area.

In Maine, a lease or easement is required for a seasonal or permanent structure that is located below the low water mark and is larger than 185 square meters (2,000 square feet) used for commercial fishing purposes or larger than 46 square meters (500 square feet) for any other purpose.

Maine State Planning Office

Figure 3.15. State of Maine approach to coastal zoning

Table 3.5. Overview of zoning approaches

	Applicability to Water Resource Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Regulatory Zoning				
Overlay Protection Districts	Provides for identification of sensitive areas for protection. Used in conjunction with other tools.	Community identifies watersheds on practical base/zoning map.	Well accepted method of identifying sensitive areas. May face legal challenges if watershed boundaries are based solely on arbitrary delineation.	Requires staff to develop overlay map. Inherent nature of zoning provides "grandfather" protection to pre-existing uses and structures.
Prohibition of Various Land Uses	Used within mapped watersheds to prohibit known water contaminants and uses that generate contaminants.	Community adopts prohibited uses list within their zoning ordinance.	Well recognized function of zoning. Appropriate technique to protect natural resources from contamination.	Requires amendment to zoning ordinance. Requires enforcement by both visual inspection and on-site investigations.
Special Permitting	Used to restrict uses within watersheds that may cause water contamination if left unregulated.	Community adopts special permit "thresholds" for various uses and structures within watersheds. Community grants special permits for "threshold" uses only if water quality will not be compromised.	Well recognized method of segregating land uses within critical resource areas such as watersheds. Requires case-by case analysis to ensure equal treatment of applicants.	Requires detailed understanding of watershed sensitivity by local permit granting authority. Requires enforcement of special permit requirements and on-site investigations.
Large-Lot Zoning	Used to reduce impacts of residential development by limiting numbers of units within watersheds.	Community "down zones" to increase minimum acreage needed for residential development.	Well recognized prerogative of local government. Requires rational connection between minimum lot size selected and resource protection goals. Arbitrary large lot zones have been struck down without logical connection to Master Plan or watershed program.	Requires amendment to zoning ordinance. Also requires more roads for dwelling unit.
Transfer of Development Rights	Used to transfer development from watersheds to locations outside watersheds.	Community offers transfer option within zoning ordinance. Community identifies areas where development is to be transferred "from" and "to".	Accepted land use planning tool.	Cumbersome administrative requirements. Not well suited for small communities without significant administrative resources or alternative sites.

Cluster/Planned Unit Design	Used to guide concentrated residential development. Allows for point source discharges that are more easily monitored.	Community offers cluster/planned unit design as development option within zoning ordinance. Community identifies areas where cluster/planned unit design is allowed.	Well accepted option for residential land development. Difficult to implement fairly if land ownership is fragmented.	Slightly more complicated to administer than traditional "grid" sub-division. Enforcement/ Inspection requirements are similar to "grid" subdivision.
Growth Controls/Timing	Used to time the occurrence of development within critical areas. Allows communities the opportunity to plan for watershed protection.	Community imposes growth controls in the form of building caps, subdivision phasing or other limitation tied to planning concerns.	Well accepted option for communities facing development pressures within sensitive resource areas. Growth controls may be challenged if they are imposed without a rational connection to the resource being protected.	Generally complicated administrative process. Requires administrative staff to issue permits and enforce growth control ordinances.
Performance Standards	Used to regulate development by enforcing pre-determined standards for water quality. Allows for aggressive protection by limiting development within critical areas to an accepted level. Encourages creative solutions.	Community identifies critical areas and establishes thresholds for water quality.	Adoption of specific performance standards requires sound technical support. Performance standards must be enforced on a case-by-case basis.	Complex administrative requirements to evaluate impacts of land development within critical areas.
Legislative:				
Regional Protection Districts	Used to protect regional water resources by establishing new legislative districts that often transcend existing corporate boundaries.	Requires provincial/ state legislative action to create a new legislative authority.	Well accepted method of protecting regional water resources.	Administrative requirements will vary depending on the goal of the regional district. Mapping of the regional watershed requires moderate administrative support while creating land use controls will require significant administrative personnel and support.

Washington State, Department of Ecology

Dykelands Zoning—Nova Scotia

Dykelands are given special zoning status in the Municipality of West Hants, Nova Scotia to minimize impacts of new residences and structures on capacity of the dykelands to absorb floodwaters and to reduce the possibility of loss of life from dyke breaches. Bylaws respecting dykelands are in place for most municipal planning strategies within the Municipality.

They:

- Do not allow new development on dykelands unless it is on pre-existing land above designated high water elevation of the dykeland;
- Do not allow expansion of existing properties for human or animal occupancy;
- Allow for recreational developments and for creation and maintenance of artificial wetlands for wildlife habitat; and
- Allow for limited development and maintenance of existing properties.

Figure 3.16. Dykeland zoning—Nova Scotia

Table 3.6. Zoning designations for rural and urban land-use in coastal areas, State of Washington

Designations	Purpose	Description	Recommendations
Natural	To preserve and restore the natural system relatively free of human influence.	An area that is unique and has valuable characteristics which are intolerant to intensive human use. The uniqueness of the area maybe primarily based on local citizen opinion. Policies regulate potential developments that would degrade or alter the natural characteristics of these areas.	Residences, commercial and industrial activities, forestry, agriculture and non-recreation is not allowed in these areas. Roads and parking areas should be located outside the designated area. Limited access for research, education and cultural activities. Land must be purchased.
Rural	To protect agricultural land from urban sprawl or expansion	Areas that are restricted from intensive development along undeveloped shorelines. Can function as buffer areas between urban environments. Open space areas that can offer recreational uses that are compatible with agricultural activities. New development in the rural environment should reflect the surrounding area through limiting overall residential density, providing permanent open space and maintaining adequate building setbacks from the water to prevent shoreline resources being degraded.	Preferred use of areas designated as rural is non-consumptive of the physical and biological resources and associated uses and activities are of a nonpermanent nature. Commercial and industrial activities should not be allowed except for agricultural practices, commercial forestry and aquaculture. Non-consumptive, water-dependant, water-enjoyment and recreation facilities are preferred uses if environmental damage is mitigated. New structural shoreline stabilization measures are not permitted except if needed to protect an existing structure.
Conservancy	To protect, conserve and manage existing natural resources and/or valuable historic and cultural areas.	Areas which have limitations (i.e., steep slopes that are erosion and slide hazards, areas prone to flooding and/or areas which cannot provide adequate water supply or sewage disposal).	Recreational activities for the public need to be done in a sustainable way. Preferably the resources within the area should be used on a sustained yield basis where future use of the resource can be maintained. Activities and uses of a nonpermanent manner, which do not substantially degrade the existing character of an area, can occur (i.e., outdoor recreation activities, passive agricultural uses (pasture and rangeland)).

Aquatic	To protect the unique features of the area that is water ward of the ordinary high-water mark. To manage uses and activities between upland and aquatic uses.	Areas that are water ward of the ordinary high-water mark (the highest water mark on beds and banks); includes streams and tidal waters.	Multiple use of over-water facilities should be encouraged. Activities that would degrade critical freshwater and saltwater habitats should not be allowed. Uses and activities shall be designed and managed to prevent damage to water quality.
Urban	To ensure best utilization of the shoreline via providing for intensive public use and by managing development to encourage and maintain the shoreline for the various urban uses.	Highly populated area near or adjacent to the coast.	Emphasis should be given to development within an already developed area, in particular to water dependent industrial and commercial uses that require navigable waters. Planning needs to be focused on public visual and physical access to the water and industrial and commercial facilities should allow for public access to the water and/or waterfront activities.
Urban-High Intensity	To ensure optimum utilization of the shoreline by providing for intensive public use and by managing development to encourage and maintain the shoreline for the various urban uses.	High intensity environment in regards to water-oriented commercial and industrial uses. Ensure best use of shorelines.	Priority given to water-dependent uses over other uses and then priority given to water-related and water-enjoyment uses'. Visual and physical public access is required.

4. FRAMEWORK OF COASTAL LAND USE PLANNING IN THE MARITIME PROVINCES

New Brunswick
Nova Scotia
Prince Edward Island

4.1 Introduction

Various provincial and federal laws in the Maritime Provinces regulate land use in coastal and shoreline (riparian) zones of freshwater streams, lakes and rivers. Legislation applying to freshwater habitats is far more comprehensive than that dealing with marine waters. Thus, this legislation is included to illustrate approaches that may be applicable to managing land use in marine coastal areas, as well as how they may be incorporated into the legislative frameworks that support the management.

Provincial land use legislation summarized in this report falls into three categories: development, environmental protection and resource use. Separate provincial departments are charged with regulating the various aspects of land use with some overlap. In general, environmental protection provisions supercede all other regulations.

Legislation also defines which jurisdictions apply to activities on land and which apply to water. Development planning legislation typically covers marine concerns, while provincial environmental protection laws typically only extend to brackish waters and estuaries. Provincial Crown resources also typically include submerged land in rivers and lakes and in certain cases the ocean up to the mean high water mark and a specified distance offshore. The division between Federal and Provincial ownership in coastal areas is not always clearly defined. However, private land and municipal jurisdiction

generally stops at the mean high water mark, although in the case of old grants individuals or municipalities can retain admiralty rights to water lots.

All three provinces have very different approaches to land use planning. Only PEI has specific provisions for development in coastal areas. PEI also extends its environmental protection legislation into coastal waters. New Brunswick is considering writing a policy that would identify coastal habitats and would direct land use for their protection. Nova Scotia has a new draft water strategy that uses water quality measurements to control land use activities affecting freshwater. In all three provinces, municipalities are starting to use tools from the legislation to create by-laws for environmental protection and coastal land use.

Provincial legislation is presented on a separate fact sheet for each province. Federal legislation applies to all three provinces and is summarized on one fact sheet. The appendices include more detailed information on statutes, policies and programs regarding coastal and riparian land use in each Maritime Province.

4.2 NEW BRUNSWICK

Land use planning in New Brunswick is primarily under the jurisdiction of the Sustainable Planning Branch of the Science and Planning Division of the Department of Environment and Local Government (NBDELG). The Planning Section and local governments implement the *Community Planning Act* and regulations. There is currently no specific provision within the *Community Planning Act* or regulations for land use planning in coastal or riparian areas of New Brunswick, except for flood risk areas. The department recently completed a "Coastal Areas Protection Policy for New Brunswick", which applies to the 5501 kilometres of coastline in the Province.

New Brunswick currently has no provincial minimum standard for planning and development at the local level. Each municipality (or the Minister for the unincorporated areas), can make their own provisions for planning. Approximately 80% of New Brunswick is unincorporated. The remaining 20% consists of incorporated municipalities such as towns, cities and villages.

The Environmental Management Division of the NBDELG regulates land use activities that could impact aquatic habitats under the *Clean Water Act*, the *Clean Environment Act* and their respective regulations. Staff are responsible for implementing the Acts and their regulations in conjunction with the regional offices. These Acts provide powers to the Minister of the Environment and Local Government in that they require anyone discharging a contaminant to obtain approval from the Minister. A contaminant is very broadly defined and essentially includes anything that is in excess of the natural constituents of the environment. Order-making powers are also given to the Minister through these Acts, which provide a means of controlling or stopping the discharge of contaminants, or of requiring the clean-up of contaminated sites. Regulations under these Acts provide administrative procedures for various systems of approvals, permits and registrations.

Presently, the legal description of most municipalities defines their jurisdiction as ending at the ordinary high water mark. This means that they have no jurisdiction to control or plan coastal structures that extend seaward, although they are becoming interested in being involved in the approval of coastal structures.

Local level planners in New Brunswick have provincial digital data available for hydrography, roads, property mapping, agricultural and forest lands, terrain models, geomorphology and soils. This data can be integrated and used for coastal mapping, providing a wealth of information. Coastal planners can use these maps as a tool for the development of sustainable coastal management strategies.

4.3 NOVA SCOTIA

Land-use planning in Nova Scotia occurs at the municipal level under the *Municipal Government Act*— the key piece of legislation that enables municipalities to do land-use planning. Municipalities can implement a Municipal Planning Strategy (MPS), or "Official Plan", through zoning and subdivision by-laws. The Act has no specific measures to protect coastal or aquatic habitat, but does provide the planning tools through which municipalities can invoke protective measures during land use planning. For instance, although there are no requirements under the Act for setbacks from watercourses, municipalities can create setbacks within the zoning by-laws. Under the *Municipal Government Act* a "*watercourse*" effectively means a lake, river, stream, ocean or other body of water.

Provincial Subdivision Regulations set up the process to divide land in Nova Scotia thereby controlling the relationship of buildings and structures to water on private land. These regulations serve as the template for all municipal subdivision by-laws and are provincially binding. Municipalities with no "Official Plan" must still adhere to the Provincial Subdivision Regulations. All municipalities must also conform to provincial building codes and to the provisions of the *Environment Act* through Environment and Labour. Building permits and subdivision approvals are processed by development officers at the municipal planning offices.

Official plans and zoning bylaws cover approximately 45% of Nova Scotia, (1999 figures). Of 55 incorporated municipalities, 21 are rural with 5 having official plans and zoning bylaws covering the entire municipality, 13 being partially covered and 3 having none. All 31 towns, except Clark's Harbour, have adopted an official plan. Of the three regional municipalities only Halifax is completely covered within an official plan.

The Province has no zoning power and cannot require municipalities to adopt an official plan. It can, however, require that any new planning conform to the Statements of Provincial Interest set out in the *Municipal Government Act (MGA)*. The Minister also has the power to invoke an interim planning area where a municipality fails to protect a provincial interest. These may include matters such as: protection of the environment; natural resources, such as agriculture or forest lands; or investments, such as those for sewer and water facilities. Within this area, the Minister can indicate what uses would be

permitted; the municipality cannot issue permits contrary to the order. The *MGA* provides for the adoption of additional statements in the future where the Province believes a Statement is necessary to protect its interests.

4.4 PRINCE EDWARD ISLAND

In 1991, PEI adopted a General Land Use Policy that indicated the province's intention to assess their current land use practices according to principles of sustainable development. The policy includes coastal area development and the protection of natural environmental systems, including beaches, wetlands, streams and estuaries. In 1992 a Coastal Protection Policy was passed as an Executive Council order. This policy made provisions for development in a coastal development areas defined as "all lands, including surface water bodies, streams, rivers and off-shore islands in the province, lying within 1640 feet (500 metres) inland and seaward of the mean high water mark of all coastal and tidal water" (*Planning Act,* Subdivision and Development Regulations).

The Coastal Protection Policy recognized that conditions in the coastal zone required different regulations than the rest of the Province. Its general intent was to control the development and subdivision of land in the coastal area and to ensure sufficient public access to the shoreline for recreation. Specific objectives were to: "protect prime resource lands and resource industry activities, including fishing, aquaculture, forestry and agriculture by minimizing land use conflicts; to retain the traditional character of the landscape; to provide or maintain coastal recreational opportunities; and to protect the natural environmental features and public health".

In a revision of the *Planning Act* and Regulations in 2000, it was recognized that the regulations respecting the coastal development area were applicable to the rest of the province. Consequently, these regulations have been incorporated throughout the entire document still adhering to the original intent of the Coastal Protection Policy.

Coastal Planning in New Brunswick

This fact sheet provides an overview of the provincial legislation that governs land use development and environmental protection in New Brunswick (NB). The following summarizes provisions applicable to coastal and riparian areas.

- The ***Community Planning Act*** *(CPA)* regulates general land use planning in New Brunswick. Regulations under the Act make provisions for more specific activities.
  Contact: NB Department of Environment and Local Government (NBDELG), Sustainable Planning Branch. Phone: (506) 444-2100.

  Section 34 of the *CPA* includes a broad statement on the prohibition of all forms of pollution and gives zoning the power to control certain types of uses in certain areas with respect to their discharge into the air, water or soil.

  Section 34(3) g provides for development on unsuitable land. District Planning Commissions can turn down development applications if the land is marshy, subject to flooding, excessively steep or otherwise unsuitable.

  Municipalities can request the designation of flood risk areas within which development can be prohibited or controlled. This by-law can also ensure that development does not reduce floodwater storage capacity (Section 41 of *CPA*).

- ***Provincial Subdivision Regulations*** regulate lot sizes for unserviced lots with on-site septic systems.

- Setbacks from watercourses are established under the ***Health Act***, NB Department of Health and Wellness.

- Environmental protection occurs through the provisions of *the* ***Clean Water*** and ***Clean Environment Acts*** administered by NBDELG.

- The ***Clean Environment Act*** provides a process for conducting environmental impact assessments under, and maintaining water quality during, industrial use.

  The Environmental Impact Assessment Regulation under the ***Clean Environment Act*** requires an environmental impact assessment (EIA) for all projects that may affect wetlands. Under the legislation, wetlands are considered to be watercourses and therefore a permit is required for any proposed activity within 30 m.

- The ***Trespass Act***, administered by the Department of Justice, can also be used to protect sand dunes. This Act prohibits the driving of motor vehicles and the construction of roads on dunes. It also prohibits driving motor vehicles in a watercourse, lake or ocean shore, or in a salt or fresh water marsh.

- The Water Quality Regulation under the ***Clean Environment Act*** is an

umbrella for approval of industrial operations. The regulation mainly applies to effluent levels in water treatment facilities. Approvals are accompanied by conditions that control construction and operating activities—including the quality and quantity of contaminants—which may be discharged from a facility.

- The ***Clean Water Act*** and its regulations allow for the control of activities that may alter a watercourse, as well as programs to protect water quality of surface water habitat and potable water supplies.

  Section 15 requires a permit to alter a watercourse and its flow. Activities include structures extending into the water, the use of machinery and the disturbance of the ground or removal of vegetation within 30 metres of the watercourse and the removal of sand or gravel from the bed. This permit applies to freshwater and coastal marshes, not estuaries or salt water.

  The Watershed Protection Program established under Section 14 of the ***Clean Water Act*** controls development in areas where the source of potable water is lakes, streams and rivers. Development activity is regulated by the Watercourse Setback Designation that defines the setback zones and what can occur.

  The draft Water Classification Regulation proposes a water quality classification system for all freshwater and estuarine environments, setting water quality standards and proposed land uses to meet these standards. The regulations may be applied to marine environments in the future.

  The Water Well Regulation and Wellfield Protection Programs aim to protect aquifers and recharge areas. This can require fencing off watercourses from cattle and setting withdrawal limits for irrigation to protect water quality and levels.

- The ***Crown Lands and Forests Act*** enables the management of Crown resources and activities below mean high water.
  Contact: NB Department of Natural Resources and Energy Crown Lands Branch. Phone: (506) 453-6621.

  Temporary or seasonal structures such as floating docks, moorings and swimming platforms, do not require formal approval for private, non-commercial use or if they are not hazardous to the coastal environment or obstruct access to the Crown foreshore. Commercial or large structures, such as marinas and multi-boat floating docks, require leases. Dredging requires a license of occupation. Permanent structures or works, such as infilling, sea-walls, wharves, boat launching ramps, breakwaters, groynes and jetties, require a lease. Permanent works, such as intake or outflow pipes and underwater cables, require an easement. Structures or works used for erosion control, such as rip-rap, bulkheads/retaining walls, infilling and sea-walls, are normally not permitted on submerged Crown lands below the ordinary high water mark.

  The ***Forest Management Manual*** sets out the standards and guidelines

that provide for buffer zones to protect riparian habitat, wildlife corridors, water quality. The New Brunswick Department of Natural Resources and Energy can create setbacks over and above the 30 metres required by the NBDELG's watercourse setback designation regulation on Crown lands.

- The ***Quarriable Substances Act*** controls the development and operation of quarries on Crown land, including 300 m above and below the ordinary high water. This includes the removal of sand and gravel on beaches. The intent is to manage the resource and protect the shoreline from indiscriminate quarrying. Contact: Director of Mines, Minerals and Energy Branch.

- The ***Endangered Species Act*** and regulation 96-26 allows for the protection of species and habitat and includes prohibiting people from approach within a 50 m radius around Piping Plover nests. Contact: New Brunswick Natural Resources and Energy, Fish and Wildlife Branch. Phone: (506) 457-6711.

Coastal Planning in Nova Scotia

This fact sheet provides an overview of the provincial legislation that governs land use development and environmental protection in Nova Scotia. The following summarizes provisions applicable to coastal and riparian areas.

- The ***Municipal Government Act*** *(MGA)* is the key piece of legislation that enables municipalities to conduct land use planning. Under the *MGA*, a watercourse includes fresh and salt water. Contact: Service NS and Municipal Relations, Municipal Services Division in Halifax. Phone: (902) 424-6642.

  Section 193 provides for the adoption of Statements of Provincial Interest (SPI) for the protection and use of land and water resources, the development of communities and guiding regional land use.

  Section 218 allows municipalities to acquire land or make an agreement with landowners for easements or other development restrictions.

  Section 220 sets out what municipalities can regulate in land–use bylaws. Subsections 4 and 5 include provisions for: buffers and non-disturbance setbacks; erosion and sedimentation control; lot sizes; excavation and infilling of land or floodplains; and performance standards. Subsection 5 (p) allows municipalities to zone individual properties as hazard land and prohibit development. Hazard lands include floodplains, steep slopes and marshy and other unsuitable land.

  Section 226 allows municipalities to create comprehensive development districts and agreements with landowners on land development.

- The ***Environment Act*** regulates water resource management, industrial land use and effluent discharge and environmental impact assessments. The Act does not directly protect salt water. Contact: NS Environment and Labour, Environment and Natural Areas Management Division in Halifax. Phone: (902) 424-5300.

  Terms and conditions for approval are set out in the following regulations:

  Activities Designation Regulations requires approvals for watercourse alteration, pesticide application, central sewage and storm drainage and industrial effluent.

  Environmental Assessment Regulations set out the process for reviewing proposed developments at the planning stage. Impacts on wetlands of 2 ha or more are subject to an environmental impact assessment (EIA) and review.

  On-site Sewage Disposal Regulations define minimum lot sizes for on-site services depending on depth of permeable soil. They specify lot size requirements for waterfront lots on a lake, river, stream or the ocean. Septic systems

must be 30.5 m from a water supply area, watercourse or wetland. Section 106(1) of the Act enables the Minister to protect an area surrounding any source or future source of water supply.

- The Draft ***Nature Reserves Protection Act*** will replace the ecological sites/nature reserves section of the ***Special Places Act***. The revision will include more protection for water and aquatic species.
  Contact: Nova Scotia Department of Environment and Labour, Natural Areas Branch, Belmont, NS.
  Phone: (902) 662-3030.

- Archeological, paleontological and historic sites are protected under the section of the ***Special Places Act*** administered by the NS Museum of Natural History.
  Contact: NS Department of Tourism and Culture, NS Museum in Halifax.
  Phone: (902) 424-6475.

- The ***Wilderness Areas Protection Act*** applies to Crown lands with provisions for adjacent private lands. Wilderness Areas may represent natural landscapes and/or preserve outstanding natural phenomena and provide a range of recreational opportunities. Section 3 defines land to include waters covering the land. Section 17 prohibits the acquisition of mineral rights, forestry or aquaculture development, power lines and agriculture or development.
  Contact: Natural Areas Branch, NS Department of Natural Resources, Belmont, N.S. Phone: (902) 662-3030.

- The ***Crown Lands Act*** requires permits for the building of structures, such as wharves, on submerged lands, peatland exploration and development, infilling and aggregate removal in coastal areas.
  Contact: NS Department of Natural Resources (DNR), Land Administration Division. Phone: (902) 424-4267.

- The ***Beaches Act*** regulates the removal of sand, gravel, stone or other material from a beach. A permit is also required to construct a path, trail or road, build a structure or use a vehicle on a beach. Activities are prohibited in designated beach areas.
  Contact: NSDNR, Manager Crown Lands Disposal. Phone: (902) 424-3160.

- The Draft ***Wildlife Habitat Management Regulations*** will apply to all forest operations on Crown and private lands and will require the establishment of special management zones along watercourses.
  Contact: NSDNR, Wildlife Division: Phone: (902) 679-6139.

- The ***Wildlife Act*** allows the NSDNR to designate wildlife management areas, which can include areas of coastal habitat such as coastal islands.
  Contact: NSDNR, Wildlife Division. Phone: (902) 679-6139.

- The ***Agriculture Marshland and Conservation Act*** protects coastal lands behind dykes from development. New development requires a variance. Municipalities

can use zoning bylaws to control development on dykelands.
Contact: NS Department of Agriculture and Fisheries, Resource Stewardship Branch.
Phone: (902) 893-6569.

- ***Aquaculture License and Lease Regulations and Sea Plants Harvesting Regulations***
Contact: NS Department of Agriculture and Fisheries, Marine Coastal Service.
Phone: (902) 424-0406.

- ***Nova Scotia Water Approval Permit***
In Nova Scotia a Water Approval permit is required if the project involves construction or maintenance of a bridge that is in a watercourse or if equipment is used in the watercourse or within 3 m from the edge of the watercourse for the: construction of a causeway, wharf, or water structure; removal of material from a surface watercourse; dredging or modification of a watercourse; installation of any foreign material; or alteration the water flow in any way.

FACT SHEET

Coastal Planning in Prince Edward Island

This fact sheet provides an overview of the provincial legislation that governs land use development and environmental protection in Prince Edward Island (PEI). The following summarizes provisions applicable to coastal and riparian areas.

- Planning in PEI is governed by the ***Planning Act*** and Subdivision Development Regulations.
  Contact: PEI Department of Community and Cultural Affairs, Planning and Inspection Services Division. Phone: (902) 366-4874.

  Subdivisions in coastal areas must retain a natural buffer to protect specific coastal habitats from encroachment or the effects of development. This buffer must be a minimum width of 60' (18 m) adjacent to wetlands, watercourses and primary or secondary sand dunes and 60' (18 m) or 60 times the annual erosion rate adjacent to beaches. Buffers can be wider if required for habitat protection. Reg. B.16(1), (7).

  The nearest exterior portion of any building or structure must be at least 75' (23 m) or 60 times the annual rate of erosion from a beach, 100' (30 m) from a migrating primary or secondary sand dune and 75' (23 m) from a wetland or watercourse. Reg. C.39(5).

  Development and road construction is prohibited on any primary, secondary or baymouth barrier sand dunes. Reg. C.40(1).

  Development is permitted on untreed, tertiary sand dunes if the development is unlikely to disturb more than 10% of the sand dune, the lot exceeds the minimum lot size requirements, or the development is unlikely to adversely alter the natural, topographical and biological features of the sand dune. Reg. C.40(2).

  Subdivisions must be built in phases, and 50% of the lots have to be built in the previous phase before approval for others is given. These regulations allow the department to control land speculation along the coast. Reg. B.18(1), (3).

  Minimum lot sizes are required to accommodate on-site sewage disposal systems. Lot sizes relate to water table depth and depth of permeable soil. Lot sizes are in three categories. This regulation is applicable to cottage development on the coast in unserviced areas. Reg.B.23 (1).

  Subdivision applicants must provide a stormwater management plan for construction and post-construction phases of a subdivision prior to receiving final approval under Reg. B.13.

  Certain conditions for preliminary approval, including providing residents of the subdivision with shore access to beaches or watercourses in the coastal area can be required. Reg. B.26(2).

  The only development allowed on coastal islands is for summer cottages

with their own water and sewer. Reg. E.64.

- The ***Lands Protection Act*** deals with land ownership. Sections 4 and 5 under the Act refer to the limits of ownership set on corporations and non-resident persons who have to apply to Island Regulatory and Appeals Commission to purchase lands once cumulative land holdings exceed 5 acres or have greater than 165 feet of shore frontage. As a condition, the land may be identified for non-development use.
  Contact: Senior Land Officer, Island Regulatory and Appeals Commission (IRAC). Phone: (902) 893-3501.

- The ***Environmental Protection Act*** provides for the management, protection and enhancement of PEI's groundwater, inland surface water, coastal estuaries and coastal sand dunes.
  Contact: PEI Department of Fisheries, Aquaculture and Environment, Water Resources Division in Charlottetown. Phone: (902) 368-5052/4684 or district offices.

  Section 9 provides for the provincial environmental impact assessment process. Development adjacent to sand dunes requires an assessment.

  Activities that may alter a watercourse or wetland, including damming, river diversion, altering land or water levels and any construction in a watercourse or wetland and within 10 m of adjacent lands requires a permit. Section 10.

  Comprehensive watercourse buffer zones restrict activities adjacent a watercourse, excluding the perimeter coastline of PEI and wetlands. The intent is to protect watercourses from siltation by defining three types of buffer zones that can be applied to watercourses: forested riparian zones; intensive livestock zones; and non-forested land zones. Section 11.

  A permit is required to construct a well. The intent is to prevent the alteration of stream and lake levels by the overuse of ground water supplies for irrigation. Section 12.

  A license is required to construct an on-site sewage disposal system. The intent is to prevent groundwater contamination or the release of contaminants into the environment, including water. Section 13.

  A permit is required to release any substance into the environment, including water that may be harmful. Discharges include solid, liquid, gas, vibration, waste, odour, radiation, and sound or combination of them, that is foreign to or in excess of natural constituents of the environment to which they are being introduced. Sections 20 and 21.

  Vehicular traffic and activities that can interfere with natural dune succession are prohibited on or across dunes and beaches except for legal business. Section 22.

- The ***Sand Removal From Beaches Regulations*** allows individuals to remove sand from below the high water mark for personal use. Commercial operations require a permit and are only permitted above the high water mark. Excavation Pit Regulations prohibit excavation within 200 m of a watercourse.

4.5 GOVERNMENT OF CANADA

Oceans Act

The *Oceans Act* provides a legislative framework that promotes an integrated approach to the management of Canada's estuarine, coastal and marine ecosystems. The Preamble to the Act lays out the requirements for oceans and coastal management based on sustainable development, integration and collaboration and precautionary and ecosystem approaches. The Act is comprised of three main parts:

Part I recognizes Canada's jurisdiction over its ocean areas through the declaration of a 200 nautical mile (nm) Exclusive Economic Zone and other maritime boundaries, including baselines, internal waters, 12 nm Territorial Sea, 24 nm Contiguous Zone and continental shelf in accordance with international law of the sea.

Part II provides for the development and implementation of a national oceans management strategy based on the principles of sustainable development, integrated management and the precautionary approach. It directs the Minister of Fisheries and Oceans to lead and facilitate the develop and implementation of integrated management plans for all estuarine, coastal and marine areas, coordinate a national system of marine protected areas and to identify and set marine environmental quality criteria, requirements and standards.

Part III provides for consolidation and clarification of federal responsibilities for managing Canada's oceans and defines the powers, duties and functions of the Minister of Fisheries and Oceans (e.g., coast guard and marine science services). The *Canadian Laws Offshore Application Act* and the *Territorial Seas and Fishing Zones Act* are repealed, and amendments are made to 27 existing pieces of federal legislation.

Fisheries Act (DFO)

The *Fisheries Act* sets out the framework for the protection and management of fish, fisheries and water habitat. DFO in association with other federal departments, such as Environmental and Provincial departments concerned with fisheries and aquaculture, share responsibility for managing fisheries. Key elements of the *Fisheries Act* affecting land use planning are the "habitat" provisions, which ensure that no activity can result in a net loss of fish habitat. Coastal projects and developments which have the potential to impact surface and coastal waters must be reviewed and approved before being allow to proceed.

***Fisheries Act*—Key Provisions**

- It is an offence for anyone to carry on any works or undertakings that result in the harmful alteration, disruption or destruction of fish habitat.
- Furthermore, it is an offence to deposit or permit the deposit of any type of deleterious substance in "water frequented by fish".
- The Act is administered by Fisheries and Oceans Canada (DFO) and Environment Canada.
- DFO is responsible for fisheries management and the protection of fish habitats.
- Environment Canada is responsible for water quality aspect of fish habitat.
- There are a number of federal-provincial agreements and memoranda of understanding delegating certain fisheries-related powers to particular provincial governments.
- The *Fisheries Act* has significant penalties for contravening its provisions.
- The courts can order violators to refrain from engaging in the activity that is the cause of a discharge or deposit into waters frequented by fish.
- The Act has proven to be very effective in prosecuting polluters.
- Courts have held that it is sufficient to prove that a substance can harm fish, without having to show that the amount of the substance found in the water has actually caused harm.
- Convictions have also occurred in cases where substances have not been deposited directly in the waters frequented by fish, but rather into places from which they might enter such waters.
- Due diligence is a possible defence under the *Fisheries Act*, if it can be shown that the accused person (or company) took all reasonable steps to prevent commission of the offence.
- DFO encourages municipalities to reference the penalties and provisions of the *Fisheries Act* in municipal bylaws respecting the protection of coastal waters and tributaries.
- The penalties resulting from violation of either the fish habitat or deleterious substance provisions of the Act are fines and/or imprisonment up to $300,000 and six months in prison for a first offence and $1 million and three years in prison for a second offence.

Figure 4.1. *Fisheries Act*—key provisions

Canadian Environmental Protection Act (CEPA)

The *CEPA* deals with the regulation and management of hazardous substances. In particular it restricts disposal at sea of materials from a variety of sources, including sediments from coastal dredging projects if they contain excessive levels of certain contaminants. Land-based disposal of dredged materials may occasionally be required because of restrictions placed by this Act.

Canadian Environmental Assessment Act (CEAA)

The *CEAA* ensures that environmental assessments be carried out on all 'projects' carried out by the federal government or in which the federal government is involved; or on projects in the private sector which are large in scope (such as surface mine or oil development). Involvement can consist of providing funding for a project or land. The main criteria for requiring an assessment are that the proposed activity is a 'project'- defined as any activity that has some federal involvement; and that involves some physical structure (e.g., a building, an airfield and an aquaculture lease). Environmental assessments under the *CEAA* are relatively uncommon, although they are being carried out more frequently. They include assessments both of environmental and socioeconomic impacts. *CEAA* assessments are currently being required of all aquaculture facilities

because they have the potential to, depending on location, obstruct waterways, which is an infringement under the *Navigable Water Protection Act*.

Navigable Waters Protection Act

No coastal structures can interfere with marine traffic, under provisions of the *Navigable Waters Protection Act*. The Act requires that all proposed developments that impinge on the marine environment be reviewed by the Canadian Coast Guard, currently within the Department of Fisheries and Oceans. The Act prohibits the "building or placement of any work in any navigable waters without the approval of the Minister of DFO" and covers most coastal structures.

National Parks Act

Canada's national parks have been developed to be a network representing major characteristic, terrestrial and marine ecosystems in all regions. Parks in coastal areas have special protection for environments found there and, as well, may have designated marine extensions, which represent undersea environments for both historical and natural heritage significance. All national parks in the Maritime Provinces include coastal areas.

National Marine Conservation Areas Act

The *National Marine Conservation Areas Act* provides authority for the establishment of National Marine Conservation Areas (NMCAs), with the objective of protecting and conserving a variety of representative aquatic environments. The Act confers a range of regulatory powers for the protection of living and non-living marine resources and their management and use in a sustainable manner.

Fishing and Recreational Harbours Act

At the time of Confederation, many Maritime harbours were designated as federal harbours. These harbours are currently managed under the authority of habour commissions, local community harbour authorities or Fisheries and Oceans - Small Craft Harbours.

Migratory Birds Convention Act

The Act gives the federal government the power to establish protected areas for migratory birds and control activity in those areas. Several Migratory Bird Sanctuaries (coastal reserves) have been established in the Maritime Provinces (e.g., Port Joli and Port l'Hebert, Nova Scotia; Black Pond, PEI and Grand Manan, New Brunswick). Regulations under this Act restrict a range of activities such as release of cats and dogs, hunting, use of boats, rock climbing near colonies, etc., deemed to be harmful to migratory birds.

Canada Wildlife Act

Some coastal areas have been designated for the protection of wildlife under *the Canada Wildlife Act*. National Wildlife Areas occur in New Brunswick and Nova Scotia (e.g., Shepody National Wildlife Area, New Brunswick; Boot Island National Wildlife Area, Minas Basin, Nova Scotia).

5. PRIMER ON COASTAL STRUCTURES

Structures for Coastal Use, Protection and Hazard Control

5.1 COASTAL STRUCTURES

Coastal areas have both an aesthetic and practical attraction to humans, and development along the coast typically leads to installation of infrastructure to use the coast in some way. Coastal structures fall into two broad categories: coastal protection and modification (e.g., seawalls, jetties, etc.); and operational infrastructure (e.g., wharves, piers, breakwaters etc.). The need for, and type of, structures depends on the characteristics of the coast and coastal processes (e.g., sediment movement, waves and currents) and the type and intensity of development found there.

Although the coasts of Atlantic Canada are largely unmodified, they support a wide range of structures serving various functions, from berths for seagoing vessels, to moorings, to small craft harbours, to piers and breakwaters. In places, such as major seaports, the coastal landscape is predominantly a man-made or built one. This section is included to provide an overview of coastal structures, since they are such an important element in the marine landscape that land-use planners have to deal with.

Biological communities in the vicinity of coastal structures frequently mirror those in the adjacent waters, although the value of the structures as habitat is frequently reduced compared to natural environments, owing to the design, treatments to reduce marine growth and environmental contamination (e.g., oil, wastes, garbage) often found in their vicinity. Structures also alter current regimes, which can affect types and patterns of deposition of sediment, change the characteristic types of organisms found and alter the overall balance of marine populations there. Some structures, however, may create habitat where it otherwise would not occur. For example, a breakwater constructed of boulders or concrete may develop growth of seaweeds and an associated community of fish and other important species, such as lobster. The practice of creating habitat in various ways (e.g., artificial reefs) to mitigate loss of habitat from coastal developments, as well as to increase opportunities for recreation (e.g., SCUBA diving parks, fishing reefs and refuges), has become common in most coastal areas of the world.

The goal of planning in coastal areas should include respect for the structures associated with coastal activities and knowledge of techniques to minimize the amount of habitat removed or affected. The current regulatory regime in Canada, which stresses the preservation of the natural marine environment or habitat of marine species —no net loss—, can serve as a guiding principle as it promotes economical and efficient coastal developments and structures. Both will assist in achieving the overall goal of having healthy and sustainable marine environments in coastal areas.

Coastal Structures- Design and Construction Principles

Overview

Coastal structures include a wide range of undertakings in the coastal zone, including access facilities, such as wharves, piers and boat ramps; shoreline protection and maintenance structures, such as seawalls; structures to trap sand for beaches or keep the mouths of coastal inlets clear of sediment; pipeline and intakes; lobster pounds and aquaculture cages; and causeways and dykes. Knowledge of coastal structures and their impacts can be useful in planning activities and in advising potential developments.

Principles:

- Coastal structures have different constraints and impacts than land-based ones, and therefore demand different planning approaches.
- Use approaches that minimize the development of coastal structures.
- Allow shoreline modification only when deemed necessary to support or protect a permitted shoreline use and ensure the adverse effects of shoreline modifications are minimized.
- Only allow shoreline modifications that are appropriate to the specific type of shoreline and environmental conditions for which they are proposed.
- Give preference to types of shoreline modifications that have a lesser impact on ecological functions (e.g., pile-supported piers allow normal water flow while landfill-supported piers alter the natural flow).

Types of Coastal Structures:
Ramps
Boardwalks and Trails
Jetties
Outfalls and Intakes
Groynes
Dykes for Land Reclamation and Shore Protection
Bridges
Wharves, Piers, and other pile supported structures
Causeways
Floating Platforms and Docks
Bulkheads
Breakwaters
Revetments
Poles and Pylons
Lobster Pounds and Aquaculture Cages

Figure 5.1. Types of coastal structures

Environmental Considerations:

- Impairment of water exchange and ice movement.
- Impairment of currents, littoral transport and deposition of sediments.
- Construction materials which contaminate the marine environment.
- Shoreline erosion control and substrate management.
- Shading and removal of natural aquatic habitat.
- Interference with recreational and other use of the shoreline (e.g., by changing shoreline topography and distribution of beaches).

Design Considerations:

- Design must balance the need for durability and resistance to ocean conditions while providing minimal interference with biological/ecological processes.
- Scale of the structure should be balanced with the carrying capacity of the environment.
- Design should include provision for both normal and extreme stresses.
- The project should be developed with an appropriate design life to the intended use of the structure, so as to ensure longevity and to minimize future maintenance and disturbance.
- Design should consider the climatology and hydrology of the area, including precipitation, 100 year storms, high-energy tidal levels, wind and storm surges.
- Project should not unreasonably interfere with existing scenic, aesthetic or navigational uses of the coastal area.
- Design should address the specific site conditions of configuration and orientation of the shoreline, as compared to currents, slope, elevation, as well as the texture and compaction of the material that makes up the shoreline.
- Environmental effects should be considered.
- Cumulative effects of the proposed structure must be examined (the effects of the structure in combination with nearby ones).

Construction Considerations:

- Shoreline structures should be designed and located to minimize damage to existing ecological values or natural resources (e.g., changes to currents).
- Structures should minimize impacts on physical regime.
- Fill should not cause water contamination.
- Timing should cause the least amount of disturbance, both to the surrounding areas and any marine or aquatic wildlife.
- Sufficient sampling must be completed to provide the appropriate in-situ soil parameters, minimizing differential settling and subsidence.
- During all excavation and/or in-filling projects, the design must consider the time period over which consolidation, bulking and de-watering will occur.
- Permanent vegetation should be preserved to prevent erosion, retard runoff and contribute to the aesthetics of the area.
- In areas where erosion and sediment control practices are not effective, severely limit excavation or other erosion causing activities.
- As watercourses in coastal areas affect adjacent waters, give special consideration to protective measures for watercourses in the construction area.
- Soil erosion should be monitored.
- Management or spoil is important to minimize environmental impacts.
- Construction activities in coastal areas usually cannot be performed without permit. Permissible activities include: dredging, bulldozing, removing or displacing soil, sand and/or vegetation; drainage or otherwise de-watering; filling, including adding sand or other material to a sand dune; and any construction repair or alteration of a permanent structure.

Associated Infrastructure

- Access roads for coastal structures should be sufficiently elevated to clear high tides with a margin to allow for storm surges.
- If possible, major highways and railways should be located landward (except if needed to access ports and industrial areas) as roads along the shoreline should be reserved for slow moving traffic.
- Design should consider effects of associated infrastructure on land and aim to ensure that impacts on the shore from access roads and other features should be minimized.

Shoreline Stabilization

- The least intrusive shoreline stabilization methods should be used, with vegetative stabilization being the least impacting method, followed by rip-rap and retaining wall construction.
- Bank stabilization measures, such as rip-rapping, should be done in a manner in which the natural character of the coast is maintained and protected.
- Shoreline protection is best carried out above the level of the highest tides and storm surges.
- Coastal protection structures can severely limit recreational activities along shorelines (e.g., swimming, waterskiing, diving, fishing and shellfishing).

Construction Materials

- Low cost materials, such as stone or gravel, native green lumber, etc., have less environmental impact than more expensive materials, such as bituminous paving and pressure-treated wood.
- Structures should use materials which result in little or acceptable environmental contamination. Avoid treated woods, which can contain toxic chemicals. In particular do not use wood treated with penta-chlorophenol or creosote. Natural untreated wood—oak for pilings, as it is strong and resists marine borers; hemlock and tamarack for timbering; spruce for removable ramps and floats. Wood-polymer composites of recycled wood and plastic and/or iron or steel pilings are also acceptable.
- Avoid preservative coatings (paint, stain) as they have minimal effect on longevity and pose an environmental threat.

Five Rules for Design of Coastal Structures

- Build the structure heavy for longevity and resistance to damage. This can be done by concentrating the weight and using fewer supports.
- Design the structure for easy maintenance (e.g., local materials that are easily handled).
- Build an open structure to allow for air and water circulation.
- Keep it small to reduce environmental impact.
- Use low-impact design (e.g., temporary floats, feet or runners on floats, moorings rather then pilings, contour shapes, etc.).

Maine State Planning Office

Figure 5.2. Five rules for designing coastal structures

Environmental Impact

- Construction effects, such as increased turbidity and sedimentation, could affect biological communities by reducing primary productivity, interfering with respiration of fish, altering the suitability of spawning areas, reducing the diversity of bottom habitat and smothering bottom organisms. Suspended bottom sediments may release toxic substances.
- Construction and associated backfilling can damage wetlands by covering narrow fringe marshes, the waterfront edge and altering water circulation in larger shorefront marshes. This eliminates waterfowl feeding, nesting and resting habitats and destroys habitats for other birds, reptiles and small mammals.
- Coastal structures should be placed so that significant wildlife or habitat is not unreasonably harmed.
- Shoreline access points to coastal structures should be linked to existing infrastructure, such as roads, hiking paths, bicycle trails and/or scenic drives.
- Access to beaches/shoreline should be by walkways or other methods.
- Ensure that access to coastal waters is preserved for commercial fishing, commercial mooring, docking and related parking facilities and for existing recreational uses.
- Mitigation of the development of coastal structures may involve:
    - avoiding an impact altogether by not taking a certain action;
    - minimizing the impact by limiting the magnitude, duration or location of an activity or by controlling the timing of the action;
    - rectifying an impact by repairing, rehabilitating or restoring the affected environment;
    - reducing or eliminating an impact over time through preservation and maintenance operations during the life of the project; and
    - compensating for an impact by replacing the affected significant wildlife habitat.

Multipurpose Structures in the Coastal Zone

Bridges

A bridge is a structure that spans natural or artificial obstacles, such as rivers, highways or railroads. In coastal areas bridges can extend from one shoreline to another over the tidal or subtidal zone. Planning and design for bridges typically involves issues on land, in water and in transitional areas. Bridges also support footpaths or roadways for pedestrian, highway or railroad traffic and are supported by piers and abutments. In general, however, bridges are used where there is deeper water to cross, or where navigation or water passage and circulation must be maintained.

Figure 5.3. Bridge and bulkhead.

- Bridge construction can disrupt coastal environments.
- Effects of coastal infrastructure associated with bridges (e.g., roadways, approaches, etc.) must be considered in any bridge construction project.
- Bridge operation and maintenance may introduce contaminants into the environment (e.g., paint flakes, non-point source pollution).
- Transportation routes can be altered so as to not require the structure at all.
- Spacing of piles and abutments should not restrict or hinder tidal movement or marine vessels.
- Height of the underside of structures must allow for passage of marine vessels.
- Bridges should be designed to minimize changes in water circulation and flow.
- Piers or pile-supported structures are recommended over solid fill.
- Bridge spans can be lengthened to reduce the number of piers or support structures in the water, although this may increase costs.
- Using steeper bridge approach slopes can reduce the footprint of bridges in ecologically sensitive areas (e.g., salt marshes or dune systems).

Causeways (Not a recommended Practice)

A causeway is an access, or raised road, which crosses marshland or water. In coastal areas, causeways can extend from one shoreline to another over the tidal or subtidal zone. Causeways normally consist of a continuous solid fill embankment constructed of earth, sand or rock either dredged or dumped in the water, or on marshy land with a roadway or pathway on it. Planning and design for causeways typically involves issues on land, in water and in transitional areas.

- In cases of severe flow restrictions, causeways can lead to enhanced downstream sedimentation.
- In tidal areas, causeways across tidal inlets can result in a reduced tidal range (lower high tide and higher low tide).
- To minimize changes in water circulation and flow, causeways should be designed with culverts or open channels through the structure.

Wharves and Piers

A wharf or pier is a structure, usually of open construction, extending into the water from a natural shoreline or a bulkhead. Components include trestles, platforms and docks. Floating piers are floating wharves anchored with pilings. The orientation of the pier depends on water depth and navigational requirements. Piers are often placed in estuaries or bays in conjunction with other structures, such as marinas.

Wharves and other coastal structures are often supported on piles—long, heavy, posts of timber, steel or reinforced concrete, that have been driven, jacked or jetted or cast vertically into the ground to support a load. A pile structure will normally be an open structure where water can circulate between the individual piles or pile clusters. Piles can also be driven in circles, squares or in other closed shapes to form bridge piers, cofferdams or caissons.

Figure 5.4. Pier

- Wharves can alter longshore sand movement and beach development in adjacent areas.
- Activity associated with wharves can have detrimental effects on the environment (e.g., boat exhaust and related emissions of oil, contaminants from wood treatments, etc. can decrease water quality).
- Pilings and other structures provide places for attachment for algae; new attachment surfaces for invertebrates; cover and feeding sites for fish; roosting for birds.
- Piers may be straight or have "L" or "T" configurations.
- Pier-based structures should not extend across more than 25 percent of any channel at mean low water.
- Floating piers should be designed to be conveniently removed and transported onto dry land.
- Solid pier structures are generally less desirable and more costly than open structures constructed from piles.
- Where possible, eliminate piers by ensuring multiple use of existing piers or launching facilities.

- Piers, wharves and pilings should be separated from property lines and other structures. In Maine, the separation is at least 8 m (25 feet) from property lines and 16 m (50 feet) from other structures below the normal high water line (Maine State Planning Office).
- Piers should not hinder public use of water, navigation or adjacent shoreline.
- Encourage cooperative use of common piers by communities, in particular for subdivisions, motels and multiple dwellings.
- Shellfish beds within 100 m of a wharf or pier are closed to harvesting under the Canadian Shellfish Sanitation Program. If possible, no wharf should be located closer than 100 m to an existing commercial or recreational shellfish bed.
- An anchor or mooring buoy can be used as an alternative to a wharf or pier. Other non-structural alternatives to piers include combining the use with other piers in the vicinity to reduce the overall number of piers; using launching ramps or other launching structures; providing for storage of vessels on land; and forming community marinas.

Wharves versus Piers

Uses of Wharves or Piers:

- Landing and mooring place for vessels.
- Loading or discharging cargo.
- Access to deep water from land.
- Boat launching and retrieval.
- Support for a hoisting mechanism on the pier.
- Recreational use such as fishing or sightseeing, platform for restaurants or other commercial ventures.

Uses of Piles:

- Mooring vessels, anchoring floating rafts or floating platforms.
- Supporting aids to navigation, such as lights, ranges, day markers or channel markers.
- As fenders or protective features for piers, landings, bridges or other structures.

Figure 5.5. Wharves versus piers

Pier Basics

Length: sufficient to allow watercraft access at all tides but not protrude into navigable waters.
Width: narrow piers are preferred over wide ones.
Shape: long, thin rectangle or a T-shape if extra edge space is needed.
Height: runway over the intertidal or salt marsh zone should be as high as possible, not less than 1.5 m (5 feet) except at the high tide line; slope the runway so that it is higher at the landward end.
Seasonal vs. Permanent: Seasonal installations are preferred over fixed piers and wharves.

Maine State Planning Office

Figure 5.6. Pier basics

Floating Platforms and Docks

Floats or floating portions of docks are floating structures held in place by anchors or piles or other mooring devices. They are used for securing boats and for recreational purposes, such as fishing and sunbathing.

- Placement buoys or floating platforms should not interfere with public usage of the waterway and should be clearly visible to boaters.
- Buoys or floating platforms can have secondary impacts, such as increased human usage of adjoining area.
- Access to beaches/shoreline should be by walkways or other non-destructive methods. Consider integrating shoreline access to existing coastal infrastructure such as roads, hiking paths, bicycle trails and/or scenic drives. Access points should be protected from erosion.
- Should be planned to include a required maintenance schedule.
- Should be separated from adjacent property lines. For example, in New Hampshire, a dock must be at least 6 m (20 feet) from an adjacent property line or the imaginary extension into the surface water, and density should be controlled. One dock is allowed for the first 22 m (75 feet) of commercial and residential property and one additional boatslip for each additional 22 m (75 feet). For marinas, the spacing is reduced to 7-8 m.
- Size of floating platforms and docks is often determined by capacity of off-season storage area.

Boat Ramps

Boat ramps are commonly used in coastal areas for launching small craft and airplanes. Ramps usually slope continuously from above high water to below low water, and are placed where water of sufficient depth occurs close to shore and where there is protection from winds and waves. Ramps would be placed in similar environmental conditions as marinas. Ramps may be constructed of gravel, shell, wood, concrete, steel, grating, asphalt or any other material with a reasonable degree of structural integrity and resistance to decay.

Figure 5.7. Concrete boat ramp

- Activities related to construction and use of ramps (e.g., dredging, protective structures, channel deepening, parking facilities and increased human usage in the area) are of greatest concern.
- Community use of ramps is encouraged over individual ownership and also helps limit the number of ramps.
- Widths range from 3 m (10 ft) to over 15 m (50 ft); lengths may vary to over 18 m (60 ft).
- Slope should be between 12% and 15% - anything less would cause trailer wheels to be submerged while launching and anything more can be dangerous.

- Piers are usually located on both sides of the ramp; sufficient pier space should be provided for boarding and for holding the boat while launching.
- If washdown of vessels is required, proper drainage facilities should be provided. Facilities drains should be connected to a sewer system rather than returned into water.
- Parking facilities should be placed on the backshore.
- Launching ramps are commonly constructed of concrete or precast slabs. Alternatives include hoists or slings operated from piers.

Nova Scotia Crown Land Boat Permit

Construction and repair or modification of any boat ramp or slipway on submerged Crown Land in Nova Scotia requires a Crown Land Boat Ramp Permit, unless the activity is a term of the lease, license or agreement with the Province. Crown Land Boat Ramp Permits may be issued for terms less than three years; or for three years with automatic renewal for subsequent three-year terms, unless suspended, canceled or revoked.

Nova Scotia Submerged Land Draft Policy

Figure 5.8. Nova Scotia Crown land boat ramp permit

Pipelines

Pipelines of varying length and width aid in the transport of materials, such as water, gas and/or sewage, and are frequently used for outfalls and intakes. Pipelines can extend over significant distances (100 m or more) in some coastal environments.

- High-energy levels, storm surges, 100-year storms, wind and wakes can lead to disturbance of pipelines.
- Construction/laying pipelines in mudflats or salt marshes is not a recommended practice.
- Pipeline failure resulting in contamination or disturbance of coastal environments.
- Depth of burial of pipelines should be sufficient such that the natural transportation/movement of sediments does not expose the line.

Outfalls and Intakes

Outfalls and intakes are often associated with commercial and industrial activities in coastal areas. Various forms of effluent such as cooling water, waste water, process water and sewage resulting from commercial and industrial activities may be discharged into coastal waters via outfall structures. Intakes typically draw cooling water for industrial usage, particularly power generation. Both intakes and outfalls are typically located at the end of a pipeline.

- Associated contamination (e.g., bacterial contamination and chlorine from sewage effluent, chemicals, hot water from industrial processes).

- Entrapment on and/or pulling in of fish through intake screening.
- Structures may become hazards to navigation or other uses.
- Structures interfere locally with currents and sediment transport processes (e.g., scouring).
- Sewage outfalls should be located remote from existing (commercial) shellfish beds or aquaculture facilities.
- Outfalls are designed to maximizing mixing.
- Time of placement/construction should avoid critical periods for local marine-related species.
- Life span and required future maintenance schedule should be considered.
- Depth of foundations and/or bury depth for any intake/outfall structure should ensure that currents or sediment movements do not expose or undercut them.

Transmission Lines, Poles and Pylons

Poles and pylons are sometimes associated with transmission lines and coastal structures built in association with recreational, commercial, industrial, residential, signage and other activities. Transmission lines vary in length and width and extend from one location to another often over coastal areas. Transmission lines may require placement of towers and supporting piers.

- Depth of foundations should be such that the natural transport of sediments does not expose or undercut their base.
- Signage should be limited to areas of high intensity land use, such as commercial and industrial areas.
- Limitations to signage include: size, height, density and lighting limitations.
- Transmission lines crossing navigable waters require marking to indicate their presence for aircraft and marine navigation (*Navigable Waters Protection Act*).
- Erected structures should not infringe on view planes.
- Viewpoints should not be degraded by signs.

Boardwalks and Trails

Boardwalks and trails are constructed in natural environments to promote ecotourism and nature appreciation in parks and in some exclusive residential housing developments. They can be coupled with other measures, such as fencing, to restrict access to and protect sensitive habitat.

- Access roads should be sufficiently elevated to clear high tides with a margin to allow for storm surges.
- Access points for trails and boardwalks should be protected from erosion.
- The slope of paths should not exceed 1:12 and existing contours should be used to guide the development of new paths.

- Trail systems should be considered in early stages of the development and before activities to reduce loss of valuable land and to minimize erosion.
- Trail systems should avoid or otherwise span wet spots, seeps, poorly drained areas and intermittent streams.
- Existing paths should be improved first, rather than building new ones.
- Worn paths should be rehabilitated by: covering with mulch; defining borders with logs, stones or ground cover; and/or other erosion control work.
- Boardwalk systems should be used in coastal developments in beach and sand dune systems to enable water access and protect the natural ecosystem.
- If signage is used in association with a trail or boardwalk system, signs should be limited in size, height, density and lighting; signs should not degrade viewpoints.
- Shoreline access points and parks should be linked by convenient hiking paths, bicycle trails and/or scenic drives.
- Design for use by the disabled.

Coastal Protection and Hazard Control— Overview and Principles

This fact sheet provides information on measures to protect coastal land and property exposed to hazards, such as erosion, and ocean processes, such as waves, winds and tides. Hazards include coastal erosion, mass wasting (i.e., slumping), storms and storm surges and sea level rise. Coastal protection and hazard control are cost-effective measures that can reduce property loss and restrict hazard areas.

Principles

- New development on the coast should recognize the dynamic nature of shorelines and minimize the need for active protection measures.
- Development should be avoided that will require protection (e.g., new structures can be setback from the coast).
- Best available techniques should be used to minimize shoreline erosion and its consequences.
- Each protective technique must be compatible with the given site; landforms and wave exposure play a significant role.
- Environmental considerations and the overall natural system must be kept at the forefront of planning for shoreline and hazard control.
- A balance between property development and/or maintenance and the dynamic shoreline system must be achieved to maintain and preserve the integrity of ecosystems.

Protective Structures

- Structures for coastal protection fall into two general classes: 'hard' structures that deflect or absorb wave energy to retain the shoreline (bulkheads, seawall, revetments, rip-rap, gabions, grout-filled bags, floating attenuators or breakwaters) and 'soft' structures, designed to dissipate wave energy; and to stimulate natural beach or shoreline development (sand and gravel fill, beach strands, beachface watering, shoreline vegetation, bluff vegetation, groundwater drainage or slope regrading).
- 'Composite' systems tend to be a combination of hard and soft type structures (groyne systems, headland/pocket beaches).
- Shoreline stabilization measures are prohibited in some areas, including in wetlands, on point and channel bars and in salmon and trout spawning areas except for fish and/or wildlife habitat enhancement (e.g., Washington State).
- Slope is an important feature in determining coastline hazard. A guideline used in Washington State indicates that if the slope is less than 20 degrees, normal development practices can be used; however, if the slope is 20 to 30 degrees, development under the supervision of a registered professional engineer may apply. For slopes greater than 30 degrees a professional engineer must certify all construction.

- If a property is known or is likely to have slide activity (i.e., soil underlain by impermeable layer such as clay; leaning and rounded trees and hummocky ground), do not develop it or do so with extreme caution.
- Restrict development for currently undeveloped coastal lands (e.g., sensitive areas, hazard areas, marsh, bog, swamp and flood areas), have setbacks, post-construction standards, public health ordinances and 'hard' structure limits.
- Provide market incentives to reduce inappropriate development (tax credits, transferable development rights and land acquisition).
- For developed coastal lands, provide incentives for relocation or removal of threatened structures.

An Approach to Shoreline Construction and Stabilization

The State of Washington has policies regulating the use of coastal structures in different kinds of coastal environments.

- Prior to shoreline modification, evaluate shoreline alternatives with preference given to soft solutions.
- Provide incentives to encourage soft solutions.
- Soft stabilization methods are preferred over hard, and hard structures should only be allowed if non-structural solutions are not of any aid.
- Rip-rapping and other bank stabilization measures should be located, designed, and constructed primarily to prevent damage to existing development.
- New development should be located and designed in a manner where the need for shoreline stabilization is minimal.
- Bulkheads are prohibited for any purpose if they will result in adverse erosion or beach starvation.
- Revetments should be situated and constructed in a manner that does not reduce water quality.

Appropriate Coastal Measures for Different Land Designations

Type of Shoreline/Classification [1]	Bulkheads	Revetments	Beach Enhancement
Natural	Prohibited	Prohibited	Prohibited
Conservancy	May be allowed as conditional use	May be allowed as conditional use	May be allowed as conditional use
Rural	May be allowed as conditional use	May be allowed as conditional use	May be allowed subject to permit conditions
Suburban	May be allowed subject to permit conditions	May be allowed as conditional use	May be allowed subject to permit conditions
Urban-Maritime	May be allowed subject to permit conditions	May be allowed subject to permit conditions	May be allowed subject to permit conditions
Urban	May be allowed subject to permit conditions	May be allowed subject to permit conditions	May be allowed subject to permit conditions
Aquatic	May be allowed as a conditional use over-water if allowed in adjacent upland environment	May be allowed over water if allowed in adjacent upland environment	May be allowed as a conditional use over-water if allowed in adjacent upland environment

[1] See fact sheet on Zoning

Washington State, Department of Ecology

Figure 5.9. An approach to shoreline construction and stabilization

Coastal Protection and Hazard Control— Structures for Shore Protection and Sediment Management

Coastal structures are used to manage ocean processes that act on the coast, such as longshore transport of sediments, erosion and tidal incursion. The use of structures for physical control of coastal processes should be considered as a last resort after proper planning and development of sites. New development requiring coastal structures should not be allowed, as it will almost certainly need long-term maintenance and modification at a high cost to the owner. In addition, coastal structures may modify the local environment, which adds cost to the community as a whole and can have 'downstream' effects on adjacent coastal areas.

Dykes

Dykes are protective structures used in some coastal infrastructure to prevent flooding, or in the case of artificial wetlands, to retain water. In Atlantic Canada, dykes have been used historically and in modern times as a barrier between tidal waters and land to reclaim and prevent flooding of rich, fertile agricultural land.

Groynes

A groyne is a rigid structure built out at an angle (usually perpendicular) to the shore to protect it from erosion or to trap sand. Its primary function is to provide or maintain a beach. Groynes can be designed in various configurations to: build or widen a beach by trapping littoral drift; stabilize a beach by reducing the rate of sand loss; or prevent accretion in a downdrift area by acting as a littoral barrier. Groynes are not used in Atlantic Canada due to the lack of typical beach areas that require them.

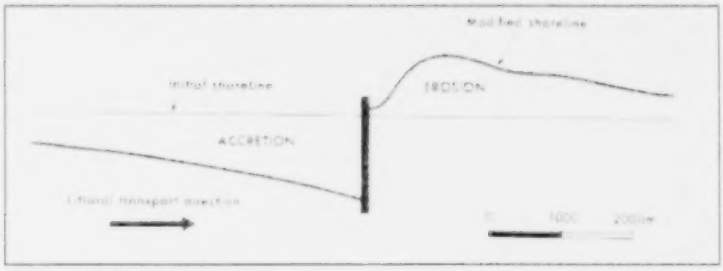


Figure 5.10. Groyne

Jetties

A jetty is a structure built at a river mouth or a tidal inlet to stabilize the channel, prevent shoaling by littoral drift and to protect the channel entrance from storm waves and cross currents. Jetties are typically placed on one or both sides of an inlet, extending from above high water on the shoreline out to the depths of the associated navigation channel, usually stretching beyond the surf zone. Natural and man-made inlets, when unaltered,

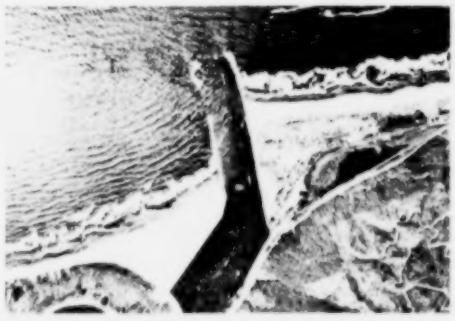


Figure 5.11. Jetty

usually interrupt the longshore movement of sand. This causes bar formation in the inlet mouth and depletion of sand on the coast in the direction of sand transport.

Revetments

A revetment is a sloped structure generally built on the natural shoreline to protect existing land or newly created embankments against erosion by wave action, currents, ice or weather. Revetments are normally used where it is necessary to retain the shore in a more seaward position relative to adjacent lands, where there is little or no protective beach in front of the land to be protected, or where it is desired to maintain a certain depth of water in front of a structure. They may also prevent undermining from wave erosion when placed along the seaward slope of eroding dunes or cliffs. Conventional revetments typically provide protection from well above the mean high water line to well below the mean low water line, and thus extend from the terrestrial zone to the subtidal zone. Revetments can also be used entirely above the mean high water line for protection against storm-generated tides. Typical revetments include rip-rap and gabions.

Figure 5.12. Boulder revetment for landing

Breakwaters

Breakwaters are structures offering wave protection to a shore, harbour, anchorage or basin, and consequently are usually placed in high-energy environments both in coastal areas and in semi-enclosed or enclosed bodies of water where there is a long fetch or high occurrence of vessel-generated waves. Breakwater placement is often determined by the existence of a shoreline area suitable for harbour facilities rather than by bottom topography, littoral processes or other factors. Breakwaters may be fixed or floating and shore-connected or detached. Shore-connected breakwaters are structurally similar to jetties and are placed according to site-specific requirements, but differ in function in that their primary purpose is to reduce wave energy, not maintain water depth. Breakwaters constructed to create a harbour may additionally protect the shoreline from erosion, alter longshore sediment transport and support pedestrian or vehicular traffic requiring access to deeper waters of a harbour or adjacent area. Detached breakwaters may be used to prevent or reduce wave penetration into a harbour entrance, or to reduce the wave attack on a costly structure, such as a seawall or a power plant.

Bulkheads

A bulkhead is a structure or partition built to prevent sliding of the land behind it. It is generally located in the vicinity of the mean high water line, but placement can range from above mean high water to below mean low water, depending on the specific purpose. Normally bulkheads are vertical, but may consist of a series of horizontal sections stepped back from the water and built parallel or nearly parallel to the shoreline. Bulkheads are similar to seawalls, although the primary purpose of a seawall is to protect the upland area

from wave attack, not to prevent the sliding of the land into the water. Bulkheads serve a number of diverse functions, such as protection of the uplands from erosion, creation of shorefront real estate, moorage of vessels and other aesthetic or recreational uses. However, their most important role is to protect against waves and currents without loss of land. In many areas bulkheads are built along shorelines and then backfilled to create or reclaim waterfront land. Bulkheads are often used where land is particularly valuable or where there is insufficient land available to provide a sloped surface or beach for protection.

Figure 5.13. Bulkhead

Table 5.1. Construction Materials for Shore

Coastal Structures	Materials
Groynes *Impermeable*	Sheet piles (wide pilings) made of wood, steel or a combination supported by piles; or quarried stone, concrete, rubble and asphalt.
Permeable	Sheet piles (wide pilings) made of wood, steel or a combination supported by piles; or quarried stone, concrete, rubble and asphalt, as well as of sandbags, sand-filled nylon tubes and earth.
Bulkheads *Sea walls*	Stem: rubble or concrete. Base: foundation piles.
Slab or sheet pile	Steel, concrete and timber.
Revetments	Cement, asphalt or bitumen grouted stone. Armour facing: rip-rap; gabion; cast concrete armour units; interlocking concrete blocks; cinder or concrete building blocks; rock overlaying a thin layer of asphalt; tires filled with sand cement; nylon fabric mats; fiberglass, steel or aluminum mats; and rubble. Filters include gravel and filter cloths. Toe protection includes aprons, buried toes, toes weighed with extra layers of armouring units, cut-off walls and anti-erosion rings.
Breakwaters	Granites and basalts are preferable to limestone, concrete, metals or wood.
Jetties	Rubble or quarried stone; steel sheet pile cells, cassions and timber, steel and concrete cribs.

Protection and Sediment Management

Environmental Considerations

Dykes

- Dykes for flood protection should be located landward of watercourses and associated swamps, marshes and wetlands.
- Fill for dykes should be vegetated and provided with retaining walls or other erosion prevention measures. Fill should be of good quality and free of contaminants.

Groynes

- Groynes can contribute to erosion and to beach loss in adjacent areas, which is at least as serious as what they were designed to prevent. Scouring on the lee side is common.
- The appearance of a shoreline on which groynes have been built changes from one with long, fairly straight stretches of sand to one with a series of indentations along the shore from each groyne in the direction of longshore drift. If the groyne is permeable, the recurring series of arcs is less pronounced than if the structures are impermeable.
- As groynes tend to accelerate beach erosion downstream by reducing the amount of sand transported to them, the placement of one groyne often leads to the need for another a distance away. A series of groynes will take longer to fill, prolonging the exposure of shorelines to erosion.
- Groynes must extend to the crest of the beach berm to ensure high wave action does not cause flanking. If the groyne extends out from a seawall or bulkhead, it should be solidly anchored to it.
- There are few alternatives to groynes. An offshore or parallel breakwater will disrupt the movement of sand along the beach by diminishing wave energy, and thereby causing sand to accumulate in the lee of the breakwater.
- Beach nourishment (artificially adding sand to a beach) can be an alternative to a groyne to maintain a beach, but it must be carried out continually.
- If the purpose of the groyne is to create a wider beach for shore protection, alternatives such as revetments, bulkheads or seawalls may be considered.

Breakwaters

- Fixed breakwaters are designed to allow for wave climate (including the maximum wave), sediment transport, bottom topography, tides and currents at the site. Studies must be undertaken on the sediment on which the breakwater will be constructed to determine what precautions must be taken to prevent settling and erosion of the foundation material.
- Deflection and absorption of wave energy from a breakwater is affected by the type of facing material, face slope, structure height, water depth and wave climate. A breakwater must be designed and constructed to allow breaking waves to expend their energy over a large area rather than at a single point.
- Floating breakwaters have unique design criteria, as some sort of anchor is necessary. Piles or other anchor devices are generally placed on the bottom with lines, cables or chains attached to the floating structures.
- Sloped walls (45 degrees or less) are better for erosion control and cost less.
- An offshore breakwater may provide protection for an eroding marsh without impacting the marsh itself.
- A harbour partially enclosed with fixed breakwaters can generate secondary waves, which result from reflection within a confined space, and which can often attain considerable size and energy. Design should consider the potential for the generation of secondary waves.
- Breakwaters should cause minimal disruption of longshore sediment transport. On relatively shallow 9 m (30 feet) or less open shorelines, fixed breakwaters are considered the better choice. Floating breakwaters interfere less with sand movement, water circulation and fish habitat, and are preferred for temporary installations in

deep water, or where bottom conditions are unsuitable for placement of a fixed structure. If disruption of littoral drift is unavoidable, provisions must be made to allow for by passing sand (taking sand from one beach and moving it to another) to avoid starvation of downdrift beaches and shoaling of waterways.

- Two or more structures placed close together can alter current patterns, causing scour damage to one or more of the structures, changes in littoral transport and alteration of water quality.

Jetties

- Jetties alter both river outflow and tidal currents, which are often felt well into an estuary, thus altering the rate of nutrient and sediment accumulation in salt marshes. Changes in flushing characteristics of the estuary, as well as an increase in wave height in the lower regions, can also occur. A single jetty can result in the opposite side of the inlet eroding severely.
- The channel formed by jetties often migrates from the original location to an area adjacent to one of the jetties, scouring the bottom and causing turbidity. The presence of jetties may limit or alter the movement of fish and invertebrates into and out of the estuary. Most of the effects of jetties are noticeable in the immediate vicinity and in the bay, river or coastal area where they are constructed. There is generally little reason to construct several pairs of jetties in proximity.
- Jetties should be designed to not unduly interfere with littoral drift or other natural shoreline processes.
- Other structures, such as groynes, can be used in conjunction with jetties to reduce or modify effects of the jetty on adjacent areas.

Revetments

- A revetment will not stabilize adjacent beaches or the foreshore in front of the structure. Poorly designed or placed revetments can cause increased erosion of adjacent beaches. Erosion of adjacent beaches may result from alterations in water circulation patterns or from the structure intruding into the littoral zone and obstructing littoral drift.
- Placement of revetments should consider: the life of the structure; waves; seasonal changes in beach profile; water level range (e.g., changes due to tides, storms, ice, etc.); beach composition; beach use; armour facing requirements; wave runup heights; toe scour depth; toe protection requirements; revetment slope; revetment length; and filter requirements, which will vary with different types of revetments.
- Revetment slope length and placement on the shoreline should be such that waves do not overtop the structure and erode away the supporting beach or saturate the soil causing structural failure due to hydraulic processes.
- Revetments possess very little internal stability, relying on the underlying beach that they protect. Therefore, undermining of the structure at its toe can result in failure of the entire structure. In general, rougher, flatter and more permeable revetment surfaces cause less toe scour and require less toe protection.
- Revetments are relatively small and the effect of a single revetment may be relatively insignificant in a coastal area. The physical and biological impacts from construction

of a number of revetments in a coastal area may have a synergistic effect, which will require site-specific attention.

- Offshore breakwaters, groynes or bulkheads may be alternatives for revetments, depending on the conditions at the site. Beach nourishment from onshore or offshore sand (moving or depositing it on beach areas) can be used to widen and raise beach profiles, thus dissipating the wave energy leading to reduced erosion of the upland areas. Vegetation can also be used to retard erosion, especially erosion resulting from wind or rain.

Bulkheads

- A bulkhead often promotes erosion of the foreshore as a result of an increase in wave energy due to waves reflecting off the face of the structure. Foreshore erosion is particularly severe during storms. Bulkheads restrict movement of sand to and from beach and dune areas, which, coupled with ongoing reflected wave energy, inhibit the recovery of sediments to storm eroded beaches.
- Irregular alignment and patchy bulkheads along a shoreline often create erosion pockets between bulkheads on natural beaches. Extensive placement of bulkheads in the vicinity of wetlands on the shores of estuaries and bays can severely reduce fish and wildlife habitat.
- The two structural classes of bulkheads are: massive freestanding gravity structures, sometimes called sea walls; and concrete slabs or sheet piles (flat piles) that are driven into the ground and anchored by tie rods.
- Bulkhead design should include consideration of the appearance and the ecological effects of the installation.
- The need for bulkheads or other "hard" shoreline modifications should be justified prior to construction, while use of other types of solutions modifications that are less environmentally adverse should be encouraged.
- A marshy soil will not be stable enough for a bulkhead and a gravel fill may be more appropriate on an eroding spit or barrier beach.
- The design of bulkheads can be altered, or they can be used in conjunction with other structures, to modify their impact. Bulkheads can be stepped back in a series of low vertical walls, which will provide some variation in depth in front of the structure. An alternative is revetments, which will provide protection to a specific site, and if designed properly will allow variable depths and allow intertidal zones to be retained.
- A bulkhead or seawall may seem like the best solution for a property that is being altered by waves, but drainage measures and re-vegetation may be a more appropriate solution if bluff erosion is related to upland hydrologic problems.

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Appendices

APPENDIX A:
Coastal Planning in New Brunswick (NB): Relevant Jurisdictions and Legislation

New Brunswick Department of Environment and Local Government

New Brunswick recently merged the two provincial departments responsible for community planning and environmental protection, thereby creating the Department of Environment and Local Government (NBDELG). The summary of departmental legislation and land use planning resources is divided between land use planning and environmental protection for this report.

A Coastal Areas Protection Policy for New Brunswick

This policy proposes land use standards, including a narrow buffer zone around coastal features that would be fairly restrictive and a wider buffer zone that would allow for more activities. This wider buffer zone, however, would be set to trigger analysis of the impacts of use.

The Policy has the following objectives: 1) to reduce threats to personal safety by storm surges and in emergency and rescue efforts during storm and flooding events; 2) to minimize the contamination of water and wetlands from hazardous materials or other contaminants, as well as to minimize the intrusion of salt water into wells; 3) to maintain buffering capacity of coastal areas; 4) to maintain the flora and fauna, for the role they play in traditional fisheries, tourism, and their value in maintaining the coastal ecosystem; and 5) to minimize public expenditures to repair storm damage and erosion.

One of the principles of the policy is that it will apply at the provincial level on all lands whether private, Crown, incorporated or unincorporated. Another key principle of the Policy is that the Policy itself will work cohesively with the existing provincial land and water use frameworks.

Another government department involved is the New Brunswick Department of Natural Resources and Energy (NBDNRE), which is the department responsible for Crown lands in the province. This department is also working on its own policy relating to wetlands. Contact: Senior Policy Advisor, Policy Branch, Policy and Educational Services Division. Phone: (506) 457-7811.

Development Officers Reference Manual on Environmental Issues

This reference guide for the district planning commissions assists development officers to incorporate environmental considerations into the land use planning process. The document is intended to provide information and guidance with respect to the programs

and policies of the NBDELG as they relate to development planning. The guide provides a quick reference to relevant NBDELG policies and regulations for the officers' consideration in the early stages of development.

Applicable Legislation

Community Planning Act
Clean Environment Act
Clean Water Act
Pesticides Control Act

Community Planning Act and Regulations

The *Community Planning Act* (*CPA*) and its associated regulations deal with land use planning in New Brunswick. Development officers and district planning commissions implement the Act. Sections summarized below apply to all areas of New Brunswick and can be interpreted for application in coastal zones. These sections include information on unsuitable lands for development, building and subdivision regulations and zoning provisions. Contact: Manager, Community Planning Section. Phone: (506) 453-2171.

Zoning

Zoning provisions are applied at the local level in order to implement policies and proposals listed in local plans. Section 34 of the *Community Planning Act* includes a broad statement on the prohibition of all forms of pollution and zoning provides the power to control certain types of uses in certain area with respect to their discharge into the air, water or soil.

Unsuitable lands

Section 34(3)g of the Act provides for situations where the land is unsuitable for development even though it may be zoned for that purpose. This section of the Act allows District Planning Commissions to turn down an application in an area, where otherwise the use would be permitted, if the land is "marshy, subject to flooding, excessively steep or otherwise unsuitable for a proposed activity by virtue of its soil or topography." This provision allows municipalities, or the Province on behalf of unincorporated areas, to protect habitat from development in inappropriate areas.

Flood Risk Area Bylaw

Municipalities can request the designation of flood risk areas within which development can be prohibited or controlled. This bylaw can also ensure that development does not reduce floodwater storage capacity (Section 41 of the *CPA*).

Provincial Building Regulation (NB Reg. 81-126)

This regulation is designed to maintain a standard of development in certain counties and along major arterial and collector highways. In the coastal areas, this provision would apply where main highways border the coast. This regulation is in the process of being applied to cover the whole province.

Provincial Subdivision Regulation (NB Reg. 80-159)

Section 6 of this regulation defines allowable lot sizes for unserviced lots with on-site septic systems; the minimum lot requirement for lots with on-site services is 1 acre. Setbacks from watercourses for on-site systems are established under the *Health Act* and are administered by the Department of Health and Wellness. This regulation applies to all unincorporated areas of New Brunswick. Municipalities may enact their own subdivision bylaws as enabled by the *CPA*. Development Officers direct subdivision applications to the divisions or departments responsible for the proposed activities, which can include watercourse alteration, on-site services, the cutting of trees and agricultural activities. Staff either approve applications or make recommendations in accordance with the mandate of their respective regulations.

Clean Environment Act

Under the *Clean Environment Act,* "*environment*" means the air, water or soil; "*water*" includes flowing or standing water, whether on or below the surface of the earth, and the ice of any body of water; and "*waters of the Province*" means all water in New Brunswick, and includes coastal water within the jurisdiction of the Province, ground water and surface water.

This Act provides for the process of conducting environmental impact assessments under Regulations and for maintaining water quality during industrial use under Water Quality Regulations.

Environmental Impact Assessment (NB Reg. 87-83)

Contact: Director of Project Assessment, Science and Planning. Phone: (506) 444-5382.

The Environmental Impact Assessment Regulation under the *Clean Environment Act* requires that certain projects be registered with the Minister of the Environment and the local government before any work on an actual project proceeds. It is also necessary to register any project intended to modify, extend, rehabilitate, abandon or demolish an undertaking that was completed before the regulation came into force. Schedule "A" of the regulation lists the types of undertakings that require registration. During the review process applications are directed to other agencies or divisions for the necessary permits or approvals (e.g. watercourse alteration permits).

In situations where a proposed activity may affect a wetland, the NBDNRE and the Watercourse Alteration staff at the NBDELG review the proposal. Under the legislation, wetlands are considered to be watercourses and therefore a permit is required for any proposed activity within 30 m of a wetland site. An environmental impact assessment (EIA) is required for all projects that may affect wetlands of 2 ha or more or Environmentally Significant Wetlands, which include coastal marshes. The DNRE is mandated to manage wetlands in New Brunswick and work with the NBDELG to implement wetland protection.

Planning Commissions and development officers route requests for rezoning or subdivision approvals through this office. Local plans can state that activities in specific areas, such as wetlands or other sensitive habitats, require approval from them as well as from provincial departments. The coastal mapping program in New Brunswick will allow planners to see the boundaries of coastal features and know which areas require an EIA (e.g. wetlands of 2 ha or more and all coastal wetlands).

Water Quality Regulations (NB Reg. 82-126)

Water Quality Regulations under the *Clean Environment Act* provide an approval process for industrial operations. The regulations apply mainly to effluents from water treatment facilities. These regulations direct a process whereby applications for approvals are submitted to the Minister and an environmental review is conducted by staff of the NBDELG. Approvals are accompanied by conditions that control construction and operation, including the quality and quantity of contaminants that may be discharged from a facility.

Clean Water Act

This Act and its regulations allow for the control of activities that may alter a watercourse and specifies programs to protect water quality of surface water habitat and potable water supplies.

Under the *Clean Water Act, "environment"* means the air, water or soil; "*water*" includes flowing or standing water, whether on or below the surface of the earth, and the ice of any body of water; "*waters of the Province*" means all water in New Brunswick and includes coastal water within the jurisdiction of the Province, ground water and surface water.

The *Clean Water Act* also identifies a *"watercourse"* as the full width and length, including the bed, banks, sides and shoreline, or any part, of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, where the primary function of which is the conveyance or containment of water, whether the flow be continuous or not.

Watercourse Alteration Regulation (NB 90-80) and Permit Program
Contact: Watercourse Alteration Headquarters. Phone: (506) 457-7363.

Section 15 of the *Clean Water Act* states that a permit is required for any alteration to a watercourse. Alterations include anything that can temporarily or permanently change the flow of water including: structures extending into the water; the use of machinery within 30 m of the watercourse; the removal of sand or gravel from the bed; and the disturbance of the ground or removal of trees and other vegetation within 30 m of the watercourse.

The Watercourse Alteration Permit applies to all open channels, natural or artificial, that hold or carry water for any part of the year. The Act defines watercourses to include lakes, ponds, rivers, streams, brooks, reservoirs, canals, ditches and wetlands, including coastal marshes. Estuaries are not covered under this legislation

The main objective of the Watercourse Alteration Regulation is to protect the banks and bed of a watercourse from activities that will unduly affect the function of the watercourse. Affected activities include vegetation clearing, soil excavation, construction and landscaping activities within 30 m of a watercourse. A watercourse alteration permit, if granted, frequently states what work may be done to the watercourse, how it is to be done, and whether or not activities are limited to certain times of the year due to flow conditions or fish migration issues.

The Department of the Environment and Local Government (NBDELG) issues two types of Watercourse Alteration Permits: the "Standard Permit" and the "Provisional Permit". The Standard Permit applies to projects large enough to involve design or investigation by a professional engineer. Examples of such projects would include bridges, dams or large culvert installations. The Provisional Permit applies to smaller projects, such as landscaping or vegetation removal.

Applications for watercourse alteration are also subject to review under the *Crown Lands and Forests Act,* administered by the NBDNRE. The NBDNRE owns all waters and submerged lands below the water and authorizes their use.

Staff at the NBDELG have the option to have projects reviewed by an advisory committee composed of representatives from the Federal Department of Fisheries and Oceans or the NBDNRE. These departments are interested in the protection of fish habitat.

The NBDNRE is also involved in identifying wetlands, including coastal marshes, and their boundaries. It is recommended that a project, which could affect a coastal wetland, receive a letter of support from the Wetlands and Coastal Habitat Program of NBDNRE prior to any commitment being made by a Planning Commission. Wetlands of 2 ha or more are subject to an impact assessment under the EIA regulations.

The Minister of the NBDELG has appointed field staff in Natural Resources and Energy to enforce watercourse alteration regulations for activities related to forestry.

Watercourse Setback Designation Regulation (NB Reg. 90-136) and Watershed Protection Program
Contact: Sustainable Planning Branch. Phone: (506) 457-4846 or the NBDELG Regional Offices.

Section 14 of the *Clean Water Act* allows the Province to establish a Watershed Protection Program to control development in areas where the source of potable water is lakes, streams, and rivers. This program protects designated watershed areas that supply municipal drinking water for the Province.

The *Watercourse Setback Designation Regulation* (WSDR) under the Act governs the Watershed Protection Program. The Program has two phases: Phase 1, which deals with setbacks from watercourses; and Phase 2, which permits the Department to control activity within the entire watershed area. To date, the Province of New Brunswick has not used the potential development control of Phase 2.

Municipalities do not have to adopt this regulation in their bylaws as most of the water supply areas fall outside municipal boundaries. However, the regulation is provincially binding in all jurisdictions, and municipalities with Rural Plans tend to adopt it as a bylaw. Some municipalities (e.g. the Greater Moncton Planning District Commission) have enhanced the regulation to make it more stringent.

Phase 1 of the Watercourse Protection Program requires a 75 m (249 feet) setback immediately adjacent to all watercourses in the drainage basin.[4,5] This protected area serves to prevent sediments, pollutants, and contaminants from reaching rivers, streams and lakes within the watershed. Within these protected areas certain activities and land uses are strictly controlled to prevent the discharge of contaminants from point sources (e.g. pipes) and some non-point sources (e.g. surface runoff from land).

The WSDR, which defines the setback zones and what can occur within them (Subsection 4), regulates development activity within this setback area. The WSDR is written in such a way that all developments, activities or things not described are prohibited within a protected area.

The WSDR also requires a 30 m 'no activity zone' within 1 km of a water intake for municipal water supply. Activities allowed within this zone include primitive recreation (e.g. camping, hunting, fishing), cutting hay and landscaping. Residential properties are required to leave a 5 m natural buffer zone between their property and any watercourse.

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[4] Watercourses include lakes, rivers and most streams within a watershed. Some very small seasonal brooks, ditches, and wetlands may not be included.

[5] The 75 metre setback applies only to watercourses that are specifically identified on plans contained in the general register of protected areas (setback zones), maintained in the office of the Minister of the Environment and Local Government. Maps showing the designated watersheds and selected watercourses can be obtained from either the Department of the Environment and Local Government or the Geographic Information Corporation Office (Land Information Centre).

Pesticide application in the watersheds is controlled by the *Pesticides Control Act*. Subsection 4 and 4i.1 of the watershed protection regulation prohibit pesticide application in a 30 m setback within 1 km of the intake and in a 15 m setback at more than 1 km of the intake.

The NBDELG works closely with several other departments (e.g. NB Supply and Services, which coordinates the sale or disposal of surplus Crown lands in New Brunswick). Usually municipalities are encouraged to purchase surplus lands. However, the NBDELG is presently trying to get approval to start managing these lands under the Watershed Protection Program, in which case they would be maintained in their current state and no additional development would take place on them. The Department also has an informal arrangement with the NBDNRE, whose staff help to monitor activities within the designated watersheds in the course of their work.

The NBDELG works with the New Brunswick Department of Health and Wellness, which is responsible for on-site septic systems under the *Health Act*. Under this Act, the tile fields associated with residential septic systems in designated watersheds must be at least 75 m from a watercourse and at least 90 m for the tank. This compares to a 30 m setback in non-designated areas.

Water Classification Regulations (Draft)
Contact: Water classification specialist, Sustainable Planning Branch. Phone: (506) 457-4846.

This draft regulation is designed to provide an administrative framework for achieving water quality goals in New Brunswick. The regulation proposes a water quality classification system for all freshwater and estuarine environments; future application of this classification system to marine environments is being considered.

The regulation will set water quality standards for each classification and propose the modification of land uses to meet these standards. The regulation will be implemented through existing permit and approval systems, such as the 30 m buffer under the Watercourse Alteration Permit. Water classification staff will be able to attach specific conditions to permits that relate directly to water quality. The regulation will be delivered through community groups and will encourage the implementation of best management practices at the local level.

Application of the regulation will involve community groups, NBDNRE (as one of the main land owners in the Province), NBDELG, New Brunswick Health and Wellness and New Brunswick Agriculture, Fisheries and Aquaculture, all of which have an interest in water quality. As part of the regulation, community groups will develop action plans for dealing with storm water and run-off. Municipalities and planning commissions will participate as stakeholders within the community groups. Municipalities will be involved in the implementation of these actions, as well as at the infrastructure level for delivery of on-site services.

Wellfield Protection Program
Contact: Sustainable Planning Branch. Phone: (506) 457-4846.

The NBDELG has initiated a program to help municipalities protect their wellfields and associated groundwater supplies. The long-term goal is to develop a protection plan for every wellfield in New Brunswick. Section 14 of the *Clean Water Act* allows for the designation of protected areas. In the case of the Wellfield Protection Program, protected areas encompass the entire recharge area associated with and surrounding a wellfield.

Each area will have a plan outlining a protected area designated around the municipal well field. The underlying principle is to control the kind and quantity of chemicals being released, used and stored in the protected area. In agricultural activities, this legislation can require fencing off cattle from watercourses and withdrawal limits for irrigation to protect water levels of surface as well as groundwater. A number of municipalities have already developed protected areas under the joint sponsorship of the NBDELG and the municipalities.

Municipal example—The Greater Moncton Planning District Commission
Contact: Chris Ready, Executive Director. Phone: (506) 857-0511.

This municipality sets an example of ways to interpret planning laws to reflect conservation priorities and standards set by the District Commission. Bylaw Z-2 outlines implementation practices allowed under the provincial Watercourse Setback Designation Regulation.

Watershed protection

McLoughlan Reservoir is the municipality's secondary water supply area. Under Zoning Bylaw Z-2, the whole watershed is protected. The bylaw outlines allowable uses within the watershed, which include: the collection and retention of water; potable water distribution and treatment; residential development; and forest management. Although the municipality cannot completely preclude housing development, legislation does allow it to control lot size and dwelling type. Lot sizes are set at 50 acres for a single dwelling residence. The municipality sets Forest Management Standards and land uses comply with Best Management Practices.

Watercourse and wetland conservation zone

The Greater Moncton Planning District Commission has also defined a P-2 Conservation Zone alongside all streams in its jurisdiction. The Conservation Zone protects watercourse and wetland habitat. It also serves as a barrier to unsuitable development that could create legal and compensation issues, especially as these areas are usually not suitable for development due to flooding and other hazards. Wetlands and other surface waters are identified in the Conservation Zones, and uses within these bands are highly restricted and include only passive recreation and conservation.

Protection of stream recharge areas

The Commission has recognized the need to protect stream recharge areas while still allowing development. The Commission encourages developers to provide for a 50% recharge and to develop sediment control mechanisms.

New Brunswick Department of Agriculture, Fisheries and Aquaculture

Several departments have recently been amalgamated under the New Brunswick Department of Agriculture, Fisheries and Aquaculture (NBDAFA). The department's responsibilities include the development of the agriculture and aquaculture industries and various aspects of fisheries.

The NBDAFA's involvement in coastal areas includes cooperation with NBDELG on the Water Classification System and Phase II of the Drinking Water Supply Protection Program. The Land Development Division works with land use management in relation to agriculture, and currently uses the watercourse alteration permit through the NBDELG for activities respecting watercourses.

The *Health Act*, administered by the New Brunswick Department of Health and Wellness, includes provisions for setbacks on agricultural lands. Section 2 of that Act states that a person who carries on an agricultural operation must adhere to existing legislation on land use, the *Health Act*, and the *Clean Environment Act*

Applicable Legislation

Aquaculture Act
Livestock Operations Act

Aquaculture Act and NB Reg. 91-158

New Brunswick has not zoned aquaculture areas and applications can be made for both Crown and private land. There are several exclusion zones in the Bay of Fundy developed as a result of consultation with commercial fisheries organizations. Aquaculture operations can involve fresh and salt waters.

All applications for aquaculture facilities (infrastructure development and operation) private land require a license. On Crown land and in the water applicants require an occupation permit or lease. Licenses, permits and leases are issued through the regional offices of the NBDAFA.
Contact: Registrar of Aquaculture, Aquaculture Division. (506) 453-2253.

Land-use controls are provided for under Section 11b and Section 25 of the *Aquaculture Act,* which grant the Registrar of Aquaculture and the Minister the right to refuse an

application or occupation permit. This right of refusal can be based on perceived conflicts with other resource uses and for environmental protection. Typically conflicts with other resource use, recreation, or environmental protection issues are determined in the referral process with other agencies.

Applications for aquaculture operations are subject to all other acts and regulations that affect aquatic habitat, such as the *Clean Water Act*, the *Fisheries Act*, the *Navigable Waters Protection Act* and the *Clean Environment Act*. Applicants for operations in freshwater must receive a permit under the Watercourse Setback Designation Regulation of the NBDELG. The two departments are currently working on an arrangement that would require applicants to have a permit from the NBDELG to operate in marine areas. The NBDELG may set restrictions on the operations for the protection of water quality.

A provincial/federal memorandum of understanding allows Fisheries and Oceans Canada to review applications for aquaculture operations. The NBDNRE also reviews applications as the landowner of Crown lands; both departments can provide conditions for approval.

Aquaculture activities are considered an undertaking and under Schedule "A" of the Environmental Assessment Regulations of the *Clean Environment Act*, and therefore may require an EIA, although most operations do not require one.

An aquaculture operation is subject to subdivision regulations under the *Community Planning Act*. The Act allows for exemptions, and aquaculture operations must receive a stamp of exemption from a municipal official before being approved.

Livestock Operations Act and NB Reg. 99-32

Under the *Livestock Operations Act*, the Department of Agriculture, Fisheries and Aquaculture can regulate livestock operations through a permit, which can include specific terms and conditions with respect to aquatic habitat.
Contact: Manager of Livestock, Agriculture Development Branch.
Phone: (506) 453-2457/5460.

Section 10 (1) of the Act provides for minimum setbacks for livestock facilities from watercourses, wetlands, water sources or other areas that are environmentally sensitive. Subsection (f) states that measures must be taken to minimize the risk of environmental degradation.

Section 5 under New Brunswick Regulation 99-2 states that applications for a livestock operation must include a copy of any watercourse alteration permit required with respect to the operation under the Watercourse Alteration Regulations under the *Clean Water Act*.

Section 6 (1) under the regulation requires a site development plan showing the location of watercourses.

New Brunswick Department of Health and Wellness

The Public Health Division of the Department of Health and Wellness (NBDHW) is currently charged with regulating land use planning issues relating to public health. Areas of service include protecting water quality for public consumption and recreation. The NBDHW works with the NBDELG to control the development of unserviced sites during subdivision. The Province is moving to shift all responsibility for on-site services to the NBDELG in future. The NBDHW is also developing a standard province-wide policy that would provide a framework for monitoring water quality of recreational waters, which would involve the owners of recreational areas.

Applicable Legislation

Health Act and NB Reg. 88-200

Health Act and Regulations

The *Health Act* and its Regulations enable the NBDHW to take part in the approval process for land subdivision when the lots require on-site services. Departmental representatives' review proposed subdivisions to determine the ability of the subdivided lands to sustain an on-site sewage system and drinking water facility. Regulations relate to setbacks and lot sizes and allow the Health Officer to refuse approval if conditions cannot be met to protect public health. The Public Health Division enforces licensing requirements for installers of on-site systems and issues permits for design proposals.

Section 14 and 15 of the *Health Act* charges the Department with controlling on-site sewage disposal to ensure that activities do not contaminate the source of water for wells and public water supplies and other non-potable water. The regulations provide for setback distances from non-potable waters and potable water supplies.

Sections 240a and b require a 30 m separation between tanks and a shoreline or high water line, and 90 m from a potable water supply. Section 258d requires 15 m between the pipes in distribution fields and a non-potable source of water, and 75 m between fields and potable water supplies.

Section 238 (1) requires that all unserviced lots requiring on-site systems be a minimum of 400 square metres.

If a Medical Officer determines that soil conditions and density of buildings would be such that the volume of sewage treated could contaminate ground water and other water sources, Section 238 (4) enables the NBDHW to request larger lot sizes, or refuse outright to approve the installation of an on-site sewage system.

Involvement of other departments

The NBDELG has the authority to approve the subdivision of land under the *Community Planning Act*, but will not approve any subdivision involving on-site services before distributing the plans to the NBDHW.

Although EIA registration is administered by the NBDELG, it refers projects to the NBDHW to identify any health-related concerns in proposals for development. The NBDHW consults with regions before responding to the NBDELG.

New Brunswick Department of Natural Resources and Energy

The Department of Natural Resources and Energy (NBDNRE) is responsible for administering land use activities on Crown lands in New Brunswick. Crown lands cover approximately 48% of the upland landmass, including all surface waters and lands beneath them. Crown lands extend below the ordinary high water mark into the ocean, and according to the definition in the *Crown Lands and Forest Act*, include salt water. This creates complex jurisdictional issues when it comes to the management of marine aquatic habitat. Both federal law under the *Fisheries Act* and the New Brunswick *Crown Lands and Forest Act* should be considered when dealing with planning and surface waters.

Activities on Crown lands are governed by Acts and regulations administered both by the NBDNRE and the NBDELG. Acts and regulations for which the NBDNRE are responsible govern activities related to forestry, mining and quarrying and wildlife harvesting, as well as providing measures to protect endangered species and ecologically significant areas.

The NBDNRE, like any landowner, is also bound by the regulations under the *Clean Water Act* and *Clean Environment Act* administered by the NBDELG. NBDNRE staff use Watercourse Setback Designation and EIA regulations to manage activities (other than forestry) adjacent to watercourses and wetlands on Crown lands. The NBDNRE is presently considering writing a Wetlands Policy, which would provide an internal means for managing wetlands.

The NBDNRE has an informal understanding with the NBDEGL to manage forest activities on Crown lands through licensing agreements with foresters. In addition, the NBDNRE works with other government agencies to manage land use activities on private land that may impact habitat on Crown lands. For instance, the department would work with the NBDELG to regulate activities upstream in a watershed.

The NBDNRE authority over Crown land is not always fully realized. For instance, an applicant may not be aware of the need to also receive authority from the NBDNRE as landowner when applying for a watercourse alteration permit from the NBDELG. At the

municipal or planning district level, issues sometimes arise where the local government is not aware of Crown lands within their planning jurisdiction.

As more interest is placed in using Crown lands for outdoor recreation, the NBDNRE recognizes the need to expand its scope to take into account this type of land use, particularly along the coast where Crown land occupies a small percentage of land above ordinary high water. The NBDNRE recognizes the importance of public coastal lands for access and recreation. It has an unofficial policy to protect the existing coastal Crown lands and, when possible, to acquire more for public access. This is reflected by the fact that the NBDNRE will no longer grant cottage leases in coastal areas.

The NBDNRE continues its participation in the provincial Coastal Lands Policy and Marine Policy initiated by the NBDELG. It continues to play an active role in other initiatives, such as Adopt-a–Stream, Conservation Easements, Private Land Stewardship and the Ecologically Sensitive Lands Program.

Applicable Legislation

Crown Lands and Forests Act
Quarriable Lands Act
Mining Act
Endangered Species Act
Ecological Reserves Act

Crown Lands and Forests Act and Leasing Regulation

This Act and regulation defines the ownership of Crown lands and designates the NBDNRE as manager of activities on Crown lands. Of particular relevance is the application of the legislation on submerged and forested land.
Contact: Crown Lands Branch. Phone: (506) 453-6621.

Submerged Lands

The NBDNRE Crown Lands Branch handles coastal development/use applications involving submerged Crown lands claiming jurisdiction over approximately 2.1 million hectares. In tidally-influenced areas or waterbodies, submerged lands are defined as those lands (and water column) located seaward of the ordinary high water mark.

The NBDNRE provides the following guidelines for its staff to follow while reviewing applications involving submerged Crown lands:

(a) Structures that are temporary or seasonal in nature, such as floating docks, moorings and swimming platforms, do not require formal approval provided they are (i) for private, non-commercial use; (ii) not hazardous to the coastal environment; (iii) reasonable in size for the intended use; and (iv) not obstructing pedestrian passage along the Crown foreshore. However, the Minister can order removal of the structures at any time should it be deemed to be in the public interest to do so. Any such structures, which are commercial or extensive in nature, such as marinas and multi-boat floating docks, require formal approval by means

of a lease. Other temporary uses or works, such as dredging, require formal approval by means of a license of occupation.

(b) Structures or works that are permanent in nature, such as infilling, sea-walls, wharves, boat launching ramps, breakwaters, groins, and jetties, require formal approval by means of a lease. Any such structures or works, which have the potential to negatively impact the coastal environment, or pedestrian passage along the Crown foreshore (e.g. infilling, groins, etc.), are normally not approved on submerged Crown lands. Permanent works, such as intake or outflow pipes and underwater cables, require formal approval by means of an easement.

(c) Structures or works used for erosion control, that are parallel to the shore, such as rip-rap, bulkheads/retaining walls, infilling, and sea-walls, are normally not permitted on submerged Crown lands below the ordinary high water mark, except in cases involving imminent danger, public health/safety, financial/personal hardship, or other instances where occupation of Crown lands may be deemed necessary by the NBDNRE. Such cases would require formal approval by means of a lease.

Water Lots

Virtually all submerged land under freshwater is owned by the Crown; what submerged land remains privately owned is in water lots granted prior to the 1880s. Following the 1880's, the Province started to reserve title of beds of rivers and lakes before granting the abutting land. As an exception, water lots in the Saint John Harbour are owned by the local government, which can control submerged land through planning regulations and zoning bylaws. Coastal water lots exist in the Lower Bay of Fundy between Grand Manan and Fundy National Park. These lots were granted to ship builders at the turn of the last century. Water lots are not specifically mapped, and identifying them requires a title search.

In addition to the departmental review of applications, other relevant agencies and stakeholders are consulted before a final decision is reached. These normally include the NBDELG, the Department of Agriculture, Fisheries and Aquaculture (NBDAFA), the federal Department of Fisheries and Oceans (Fish Habitat and Coast Guard), the local planning commissions and municipalities.

As owner of Crown land, the NBDNRE is involved in leasing agreements for aquaculture in conjunction with the NBDAFA. The NBDNRE also participates on a review committee for introductions and transfers of fish species.

Forest Management Manual

One of the major uses of the *Crown Lands and Forests Act* is to regulate use of forest resources. Section 29(4) of the Act describes the manner in which land will be managed for timber licenses. This section also indicates that the Forest Management Branch uses the *Forest Management Manual* to manage timber activities. This manual sets out the standards and guidelines to which industry has to adhere. Standards include buffer zones

for the protection of riparian habitat, wildlife corridors, water quality, etc. The *Forest Management Manual* is implemented through legally binding forest management agreements.

On Crown lands the NBDNRE has the power to enact setbacks over and above the 30 m required by the NBDELG's watercourse setback designation regulation. On lands 600 ha or less, the NBDNRE can approve watercourse crossings and other alterations that are defined by the applicant in an annual operating plan. On lands greater than 600 ha, infrastructure development, such as watercourse crossings, requires approval by the NBDELG through the watercourse setback designation regulation.

Quarriable Substances Act and NB Reg. 93-92

This Act and regulation enables the NBDNRE to control the development and operation of quarries on Crown land. The department is also proposing a Pits and Quarries Policy that would provide them with more authority for quarry activities on private land. Contact: Director of Mines, Minerals and Energy Branch. Phone: (506) 453-6637.

Pit and Quarry Development on Crown Land

The Minerals Branch of Natural Resources and Energy, through the *Quarriable Substances Act* and Regulation 93-92, controls the extraction of materials from Crown land and from areas of the shore that lie within three hundred metres above and three hundred metres below the ordinary high water mark. The intent of the Regulation is to manage the resource and protect the shoreline from indiscriminate quarrying, including the removal of sand and gravel from beaches.

Anyone planning to develop or operate a quarry on any Crown lands or in the 600 m zone on the coast (i.e. 300 m above and 300 m seaward of the ordinary high water mark) must apply to a district office of the NBDNRE for a permit. If a permit is issued, it will outline the conditions under which the quarrying can take place. Some conditions apply to all applications, while others are site specific. In all cases the permit requires a 60 m setback from any watercourse on Crown land and permits will not be issued to excavate sand dunes.

In order to process a quarry lease application, a company is required to submit plans including, among other things, the location of natural features and watercourses, a description of the source, quantity and use of water during operation, plans to mitigate discharge and a detailed reclamation plan (conditions set out in the permit dealing with the development, operation and reclamation of the quarried area). For pit and quarry development, conditions include prohibiting the removal of material from within 60 m of any watercourse and from below the water table. Pit and quarry operations require a Watercourse Alteration Permit from the NBDELG for the withdrawal of water from a watercourse and for stream crossing or watercourse alterations. Quarrying on private land is also subject to the 30 m Watercourse Setback Regulation administered by the NBDELG.

Public Works and Government Services Canada dredges harbours on a regular basis and have an on-going permit. For any other dredging operation, the NBDNRE would involve the federal Department of Fisheries and Oceans under the *Fisheries Act*.

Municipalities can have their own permitting system for opening and operating a quarry. Excavation within municipal jurisdiction that is within 300 m of ordinary high water, and for dredging, also require a permit from the Province. Municipalities can set zoning bylaws to regulate sand and gravel operations in coastal areas.

Pits and Quarries Policy (DRAFT, December 2002)

This policy, presented in the New Brunswick Jurisdictional Report (October 2000), establishes quarriable substance resources as a matter of provincial interest. It includes specific measures to ensure that regard is paid to the importance of quarriable substances and to the social and natural environment, and that the overall provincial interest is taken into account in any related planning action.

Principles of the Policy are: (a) sources of quarriable substances on both private and Crown lands will be identified and classified; (b) identified sources will be reserved for extraction purposes; (c) Provincial performance standards will define a minimum set of development, operational and closure standards for all pits and quarries in the Province; and (d) a permit will be required for extraction of all quarriable substances, from both Crown and private lands. The exception to this requirement will be Department of Transportation (DOT), which will be responsible for applying the performance standards on wayside pits and quarries operated for highway purposes.

Mining Act and General Regulation (Reg. 86.98)

Contact: Director of Mines, Minerals and Energy Branch. Phone: (506) 453-6637.

The intent of this Act and regulation is to promote mineral exploration and development and to allow management of Crown resources. Anyone can stake a mineral claim anywhere in the Province without the landowner's permission, with the following exceptions: ecological reserves; national or provincial parks; areas withdrawn from prospecting for specific reasons; and areas already held as a mineral claim.

The NBDNRE has an arrangement with the NBDELG that allows the NBDNRE staff to approve applications for exploration within a Watercourse Setback Designation.

All mining activities have to abide by all other laws of the province of New Brunswick that affect land use. The NBDNRE cannot give permission to explore in watersheds designated under the *Clean Water Act* for various purposes, and proponents must apply to the NBDELG to determine applicability under the watershed protection program. Section 109 (4) of the *Mining Act* also requires that anyone staking a mineral claim in an incorporated municipality needs permission from the local government before starting work.

Mineral development and production activities are dealt with by a Standing Committee on Mining in the Environment that is composed of representatives of the NBDNRE, the NBDELG and Environment Canada. This committee determines whether applications need an EIA or other permits or authorizations.

Endangered Species Act and Regulations (NB Reg. 96-26)

Contact: Fish and Wildlife Branch. Phone: (506) 457-6711.

The *Endangered Species Act* allows for the protection of species and habitat, as described in the regulated list of endangered species in New Brunswick. The Act states that people who knowingly and willfully infringe on habitat can be charged, and that critical habitat should be marked by signage (e.g. on beaches prohibiting approach within a 50 m of Piping Plover nests). Staff can use the *Trespass Act* to charge persons driving an ATV without a vested interest on a beach. Municipal and regional planners send requests through the Crown Lands Branch for information on sensitive habitat, which are reviewed by staff from the Fish and Wildlife branch.

Ecological Reserves Act

Although the *Ecological Reserves Act* is in place, the NBDNRE is currently revising its approach to protection in New Brunswick, including a proposed Protected Areas Strategy. In the interim, the *Ecological Reserves Act* is inactive and the needs addressed by the Act fall under Section 8 of the *Crowns Land and Forests Act.*

The NBDNRE has also been involved in the federal initiative to establish Marine Protected Areas (MPAs); Musquash Harbour is under review as a candidate MPA site. Staff can use the *Trespass Act* to charge people using a motor vehicle in an ecological reserve established under the *Ecological Reserves Act* and in any area designated by the Lieutenant-Governor in Council as a wildlife refuge or a wildlife management area under the *Fish and Wildlife Act.*

Protected Areas Strategy

Contact: Natural Area Section, Crown Lands Branch. Phone: (506) 453-2437.

This strategy targets the protection of biodiversity by identifying several large representative areas for protection based on biological and geographic criteria. In addition, it will identify a methodology for identifying and protecting biodiversity at a site-specific scale and will include acceptable land uses for these areas. It will also be identifying opportunities to enhance biodiversity conservation from a cross-jurisdictional perspective by recognizing ecosystem functions, interrelationships, interdependence and associated natural processes.

Wetlands and Coastal Habitat Program
Contact: Wetlands and Coastal Habitat, Fish and Wildlife Branch. Phone: (506) 453-2440.

The Fish and Wildlife Branch of the NBDNRE is charged with the management of wetlands in New Brunswick. Part of this management includes identifying and mapping fresh and salt water wetlands and their boundaries and establishing an atlas of provincially significant wetlands. Provincially significant wetlands are protected by a 30 m natural buffer, with restrictions placed on activities in the buffer. The NBDNRE is also drafting a wetlands policy that could provide the Branch with direct legislative power for the management of wetlands. The NBDNRE uses the provisions of the New Brunswick Department of Environment and Local Government's legislation for wetland protection. These include the Watercourse Setback Designation Regulation under the *Clean Water Act* and the Environmental Assessment Regulation under the *Clean Environment Act*. The former requires permits for activities within 30 m of a wetland, and the latter an EIA for any activity that may impact a wetland of 2 ha or more. The NBDNRE provides technical advice if a project triggers an EIA.

Municipalities or commissions interested in conserving or protecting wetlands can work with the NBDNRE under the Wetlands and Coastal Habitat Program. Projects, which could affect a coastal wetland, should receive a letter of support from the Wetlands and Coastal Habitat Program prior to any commitment being made by the Planning Commission. *Provincially Significant Wetlands* are identified and mapped under this program.

New Brunswick Wetlands Conservation Policy

The management and protection of wetlands in New Brunswick is primarily the responsibility of the NBDNRE (wetland habitat and biodiversity functions) and the NBDELG (ground and surface water quality and quantity functions; flood control functions). The objectives as currently stated in a draft of Provincial Wetlands Policy are: (a) to manage human activity on or near wetlands in a manner which will achieve no net loss of wetland function, and no loss of Provincially significant wetland; and (b) to promote and facilitate the development of wetland stewardship, awareness and education through government initiatives and through cooperative relationships among local citizens, stakeholder groups, the private sector and municipal, provincial and federal governments. Most of the policy's principles, statements, and objectives have been integrated into a departmental "operating policy" through the activities of the Wetlands and Coastal Habitat Program and through the regulatory review processes administered by the NBDELG.

New Brunswick Department of Justice

Trespass Act

The *Trespass Act* can be used to protect sand dunes. This Act is administered by the Department of Justice and prohibits the driving of motor vehicles on or across dunes and the construction of roads across dunes. It also prohibits driving motor vehicles in a watercourse, lake or on an ocean shore, in a salt or fresh water marsh and in any other any area that the Lieutenant-Governor in Council has designated by regulation as an area in need of protection from environmental damage.

APPENDIX B:
Coastal Planning in Nova Scotia (NS): Relevant Jurisdictions and Legislation

Service Nova Scotia and Municipal Relations

The Municipal Services Division, Service Nova Scotia and Municipal Relations (SNSMR) is charged with maintaining the legislation that allows the regulation of development on private land, while development on Crown lands falls within the jurisdiction of the Nova Scotia Department of Natural Resources (NSDNR). As a matter of policy, the SNDNR follows municipal bylaws for development on Crown land. The SNSMR has written *Implementation Guidelines* for elected officials, planning advisory committees, municipal planners and the public to assist municipalities in using the Statement of Provincial Interest (SPI) in their planning.

The Municipal Services Division is also involved with policy and program support on matters of provincial-municipal interest, interdepartmental environmental and resource planning concerns and overall structures related to communities and local government in Nova Scotia. The Divison can also work with the federal government (for example, the Canada-Nova Scotia Flood Damage Reduction Program and the Sustainable Communities Initiative).

Applicable legislation

Municipal Government Act
Provincial Subdivision Regulations NS Reg. 38/99

Municipal Government Act

The *Municipal Government Act* covers all aspects of land development, except on-site septic development, which is covered under the Nova Scotia Department of Environment and Labour's (NSDEL) On-site Sewage Disposal Systems Regulations. The NSDOEL is involved at the lot assessment stage of the subdivision planning.

Water supply

Section 193 defines the *Minister's* powers regarding SPIs. The guidelines under the Drinking Water SPI state that planning documents must identify all municipal water supply watersheds within the planning area and address the protection of drinking water in municipal water supply watersheds.

Land acquisition

The municipality has the rights of expropriation. They can, under Section 218 of the Act, acquire and assemble land for the purpose of carrying out a development consistent with the

municipal planning strategy, or make an agreement with the landowners to impose easements or other development restrictions on the lands.

General Zoning Powers

Section 220 of the Act sets out the use of bylaws by municipalities for regulating land–use.

Subsection 4 (f) "regulates the size, or other requirements, relating to yards". Although the municipalities can not prevent cutting, they can make provisions in a Municipal Planning Strategy (MPS) for leaving vegetated buffers beside watercourses. The municipality can determine the composition and size of the vegetation buffers. This non-disturbance setback occurs at the building permit stage through the development officer.

In relation to development, Subsection 5 (d) provides for "the planting or retention of trees and vegetation for the purposes of landscaping, buffering, sedimentation or erosion control." This Subsection does not prevent a landowner from cutting trees for commercial or other reasons.

Subsection 4 (a) "regulates the minimum dimensions for frontage and lot area for any class of use and size of structure." This provision enables the municipality to establish different lot sizes for different types of uses. The Department of Environment and Labour can require larger lots sizes than allowed for in the zoning if they determine that the soil conditions require larger lots to control density of septic systems. In some cases, such as in water supply areas, municipalities have used this provision to zone for lot sizes of 4 to 5 acres.

Subsection 5 outlines other provisions under an Official Plan that can become zoning bylaws in relation to a development:
g) "regulate or prohibit the altering of land levels, the excavation or filling in of land, the placement of fill or the removal of soil unless these matters are regulated by another enactment of the Province;
(h) regulate or prohibit the removal of topsoil;
(j) set out conditions, including performance standards, to be met by a development before a development permit may be issued;
l) prescribe methods for controlling erosion and sedimentation during the construction of a development;
m) regulate or prohibit excavation, filling in, placement of fill or reclamation of land on floodplains identified in the land-use bylaw; and
(o) prohibit development within a specified distance of a watercourse."

Subsection 5 (p) provides for lands that would not be suitable for development because they could pose a threat to the development. These include: land subject to flooding or subsidence; steep slopes; low-lying, marshy or unstable land; land that is otherwise hazardous for development because of its soil conditions, geological conditions, undermining or topography; and land located in an area where development is prohibited by a statement of provincial interest or by an enactment of the Province.

Municipalities can zone individual properties as hazard land and prohibit development. Five Nova Scotia areas are designated under the provincial flood reduction program, but many areas that have not been designated have a risk of flood. An approach to development control in flood-risk areas is to make provisions for setbacks and buffer zones in a development agreement.

Section 226 of the *Municipal Government Act* allows municipalities to create comprehensive development districts. The municipality would enter into an agreement with landowners on how the land will be developed. Conditions for lot layout, roads, types of development, etc. would be determined and set out prior to subdivision approval.

Examples of Municipal Government Initiatives

Eastern Passage/Cow Bay Municipal Planning Strategy

EP-7 It shall be the intention of Council, through the land use bylaw, to establish a building setback and buffer of two hundred (200) feet for those coastal lands as shown on Map 4 - Environmental Constraints. No structure, excavation, infilling or grade alteration shall be permitted to occur within the setback/buffer area and the retention of natural vegetation within the area shall be part of these requirements. The land use bylaw shall contain provisions to reduce this requirement to one hundred (100) feet for those lots in existence on the effective date of this planning strategy and if otherwise development would be prohibitive.

Herring Cove Area Settlement and Servicing Strategy

This coastal area developed an interim planning strategy in order to maintain the integral character of the village in the face of increasing development allowed by water and sewer services. This strategy is a good example of progressive use of planning tools in a coastal area. Statements include zoning of wetlands, watercourses and buffer zones around wetlands and watercourses as environmentally sensitive, and prohibiting the infilling of watercourses, wetlands and floodplains. The strategy has provision for maintaining vegetation on slopes 16% and greater, and also specifically identifies the MacIntosh Runs, a local watercourse, as fish habitat requiring protection in cooperation with the NSDOEL and DFO.

Nova Scotia Department of Environment and Labour

The NSDEL, Environment and Natural Areas Management Division, is charged with managing surface and groundwater resources, with regulating industrial land use activities, environmental impact assessments and wilderness protection. The Protected Areas Branch is responsible for wilderness areas, nature reserves, heritage rivers and the inventory of and evaluation of natural areas throughout the province. In Nova Scotia the *Environment Act* takes precedence over other provincial legislation. The Department uses a system of permits and approvals under the *Environment Act* to manage industrial activities and the physical impacts of activities on water resources. The regulations apply to activities on private and Crown land. The *Environment Act* also charges the NSDOEL

with establishing a water strategy to manage quantity and quality of surface and groundwater in Nova Scotia.

Applicable Legislation

Environment Act and Regulations
Wilderness Protection Act
Special Places Act

Environment Act and Regulations

Administered by the NSDOEL, the *Environment Act* is the principal law dealing with regulating the impact of human activities on the environment in Nova Scotia. Key provisions relating to water and coastal uses include the use of approvals and certificates for regulation of effluent and discharge from industrial activities and the terms and conditions for which are set out in regulations. The Minister may also make approvals subject to more stringent terms and conditions in environmentally sensitive areas. Approval Procedure Regulations lay out the grounds for issuing and refusing requests in the general approval process, and include checking compliance with other statutes; all applications affecting waters are reviewed according to specifications from the Habitat Branch of DFO.

The Act also makes provisions for the establishment of protected watersheds for water supply. The following regulations make provisions for watercourse alteration, water quality respecting drinking water and the environmental impact assessment process.

- Activities Designation Regulation (NS Reg. 48/95)
- Environmental Assessment Regulations (amended to NS Reg. 71/2000)
- On-site sewage disposal regulations (NS Reg. 51/97)
- Petroleum Management Regulations (NS Reg. 62/95)

Activities Designation Regulations NS Reg. 48/95

The regulation lists activities that must be approved further to the *Environment Act*. Activities include: watercourse alteration, pesticide application, sewage, storm drainage and industrial effluent. The NSDOEL staff can control activities by setting out conditions for approval. These must meet, at a minimum, provisions made in other statutes. Conditions for approval may require setbacks or other defined guidelines. Aquaculture is being considered for future inclusion as an activity under these regulations. Contact: Ecosystem and Risk Management Branch. Phone: (902) 424-2553.

Watercourse Alteration

The physical alteration of watercourses is controlled through water approval permits in Section 5 (1) of the regulations. Under the *Environment Act*, a *"watercourse"* means: (i) the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the Province, whether it contains water or not, and (ii) all ground water. This section defines activities that require a permit including:

withdrawal of water; construction or maintenance of a bridge in a watercourse; use of equipment in a watercourse or within 3 m of the edge of a watercourse; construction of a causeway, wharf, or water structure; removal of material from a surface watercourse; dredging or modification of a watercourse; installation of any foreign materials; or alteration of the water flow in any way.

Municipalities can have their own bylaws regarding watercourse alterations that require approval from a development officer. The NSDOEL may also ask development officers to review the provincial approvals. Water approval applications can also be reviewed by staff at the DFO and through watershed advisory groups. Permits are issued through the NSDOEL's regional offices.

Pesticide Application

Section 6 of the Activities Designation Regulations requires a pesticide approval permit for specified uses, including the application of pesticides over or on surface water.

Sewage and Storm Drainage

Section 7 of the regulations refers to central sewer and storm water drainage facilities in subdivisions or owned by municipalities. An approval is required for collection plants, treatment facilities and storm drainage. Approvals are issued through the *Municipal Government Act* and requirements are outlined in the Nova Scotia Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage. The SNSMR has a model sewer bylaw that municipalities can reference when developing their own.

Industrial Effluent

Sections 11 through 22 of the Activities Designation Regulations include provisions for protecting water quality from effluent during industrial activity. Applicants must prove that they will not harm water quality before receiving approval. Permits are issued through the regional offices and can include setbacks from watercourses.

Environmental Assessment Regulation (NS Reg.71/2000)

Contact: Environmental Assessment Administrator, Environmental Assessment Branch. Phone: (902) 424-2574.

Environmental assessment in Nova Scotia is led by the Environmental Assessment Branch of the NSDOEL. EIAs review proposed developments at the planning stage. Schedule "A" of the regulations outlines undertakings that are subject to an EIA. In Nova Scotia activities impacting wetlands of 2 ha or more are reviewed through this office. An EIA is legislated by Part IV of the *Environment Act* and the environmental assessment process is set out in the Environmental Assessment Regulations and the Environmental Assessment Board Regulations. A *Guide to the Environment Act and Regulations* is available on the internet at www.gov.ns.ca/enla/pubs/guide.pdf or by contacting a branch office of NSDOEL. Municipalities maybe involved by providing comments at the assessment level.

On-site Sewage Disposal Regulations NS Reg. 51/97

Section 8 in Schedule "A" of these regulations defines minimum lot sizes for on-site services, which are determined based on depth of permeable soil. This section specifies lot size requirements for waterfront lots, which include any lot within 60 m of a lake, river, stream or the ocean.

Section 12 defines the clearance distances from on-site systems and other activities. Septic systems must be 30.5 m from a water supply area, watercourse or wetland. The regulations are provincially binding and development officers must ensure that anyone submitting a subdivision plan complies with their provisions. These regulations also include oceans in the definition of watercourse. The regulations came into effect prior to the *Municipal Government Act*, in which municipalities can establish setbacks for development.

Petroleum Management Regulations (NS Reg. 62/95)

Contact: Engineering specialist for petroleum management, Environmental Management Branch. Phone: (902) 424-2559.

The intent of these regulations is to eliminate or reduce the release of petroleum products into watercourses (e.g. fueling activities at marinas).

Water and Wastewater Facility Regulations (NS Reg. 140/2000)

Contact: Hydrogeologist, Ecosystem and Risk Management Branch. (902) 424-2553.

Requirements for certified operators for water and wastewater facilities in the province are regulated under the Water and Wastewater Facility Regulations. These regulations detail the requirements for classification of water treatment, wastewater treatment, water distribution and wastewater collection facilities, as well as the requirements to have certified operators for these facilities. Facility Classifications are administered through the Department's regional offices and the Operator Certification program is administered through the Halifax office.

Protected Areas (Water Areas)—Designations and Regulations

Section 106(1) of the *Environment Act* enables the Minister to designate an area surrounding any source or future source of water supply as a protected area. Operators or a municipality can apply to have an area designated and to regulate activities. Terms and conditions for activities depend on the nature of the watershed. This can also apply to designated well fields in groundwater recharge areas. The SPI on drinking water under *the Municipal Government Act* of SNSMR requires municipal planners to consider watershed areas. If municipalities need to be more restrictive they can use the *Environment Act*.
The following water areas are currently protected:

James River Protected Water Area - Antigonish County (NS Reg. 218/88)
Lake Major Watershed Area (NS Reg. 57/86 and 154/92)
North Tyndal Protected Water Area (NS Reg. 200/92)
Pockwock Lake Watershed Protected Water Area (NS Reg. 12/95)

Port Hawkesbury Watershed (NS Reg. 149/82 and 116/85)
Mill Lakes Watershed Protected Water Area (NS Reg. 264/86)

Nature Reserves Protection Act (Bill 73) (Draft)

Contact: Natural Areas Branch. Phone: (902) 662-3030.

The ecological sites/nature reserves section of the *Special Places Act* is being revised to provide more protection for water and aquatic species. The revised Act will also include provisions to notify municipalities and other landowners when an area is designated. Nature reserves tend to be relatively small sites, primarily identified to protect unique, rare, or outstanding natural features for scientific research and education.

Wilderness Areas Protection Act

Contact: Natural Areas Branch. Phone: (902) 662-3030.

This Act applies to Crown lands with provisions for adjacent private lands. Wilderness Areas may represent natural landscapes and/or preserve outstanding natural features and provide a range of recreational opportunities. In Section 3, the definition of "*land*" includes "areas where waters cover the land, and all the waters thereon." Section 17 prohibits the acquisition of mineral rights, forestry, aquaculture development, power lines, agriculture or development. Permitted uses include trail development according to an agreement, development of wilderness campsites and hunting and fishing according to regulations of other Acts with other imposed conditions.

Nova Scotia Department of Natural Resources

The Department of Natural Resources (NSDNR) has three divisions: mining, wildlife and forestry. Each division maintains its respective Acts and regulations. In addition to legislation the NSDNR uses a variety of policies and programs to fulfill its mandate.

The NSDNR is charged with managing activities on Crown lands in Nova Scotia, which encompass approximately 25% of the land above mean high water. Crown land also includes land below mean high water seaward, river and lakebeds and water in rivers and lakes. Under this definition, the NSDNR assumes responsibility for aggregates in coastal areas. Wetlands are excluded from the definition of Crown land.

Minerals are considered another Crown interest and the department maintains a policy regarding mineral activities in designated water supply areas. The Department is currently working towards a policy on reclamation planning for current and future mine sites. Mine reclamation is designed to restore to an acceptable state the physical, chemical and biological quality of land and water disturbed by mining. The NSDNR also recognizes the need to make geological information readily available to land use planners.

The NSDNR also administers activities relating to forestry and wildlife management. These divisions are currently working together on new regulations to provide more stringent

measures for the protection of wildlife habitat, including watercourses, during forestry operations on Crown and private lands.

The Wildlife Division of the NSDNR is also charged with administering Nova Scotia's involvement in the North American Waterfowl Management Plan. This program enables the Department to initiate protection measures for coastal and freshwater wetlands and adjacent upland habitat including coastal islands

Increasing pressures for access to the limited Crown land base and its resources have led the NSDNR to implement an Integrated Resource Management (IRM) process for provincially managed Crown lands. IRM is an internal policy that directs the management of Crown resources. This new approach aims to balance the varied interests of the Department and mitigate potential land use conflicts. All applications for activities or leases on Crown lands now go through an IRM review by staff from forestry, wildlife and mining. Municipalities with an interest in Crown land should contact the Regional Resource Manager in their district.

Applicable Legislation

Crown Lands Act
Beaches Act and Regulations
Mineral Resources Act and Regulations
Draft Wildlife Habitat Management Regulations
Wildlife Act

Crown Lands Act

Contact: Land Administration Division, Land Services Branch. Phone: (902) 424-4267.

The NSDNR functions as the landowner of Crown lands that are under the administration of the Department. As with any other landowner, activities taking place on these Crown lands require permission from the Minster of the NSDNR. The *Crown Lands Act* covers activities not specifically provided for under other NSDNR Acts. These activities include the building of structures attached to submerged lands, such as wharves, peatland exploration and development, infilling and aggregate removal and the allocation of forest resources. The *Crown Lands Act* allows the Minister to set terms and conditions for approvals that tie in with requirements of other provincial or federal legislation.

Water Lots

Prior to Confederation, Nova Scotia did not use the mean high water mark as the boundary for private lots. Therefore, deeds granted before that time can include submerged lands, which are known as water lots. Water lot grants fall under the general conveyance conditions of the *Crown Lands Act.* Under Common Law the public have the right to navigate through a water lot.

Some of the structures in Small Craft Harbours (harbours established under the *Federal Fishing and Recreational Harbours Act)* are on Crown land. As part of the marine facilities

divestiture program initiated by the federal government, the province can transfer land title, including a portion of the coastal waters, as a water lot.

Beaches Act and NS Reg. 70/89

Contact: Manager Crown Lands Disposal, Land Administration Division.
Phone: (902) 424-3160.

The intent of this Act and its regulation is to protect beaches and associated dune systems. The Act defines *"beaches"* as "any area of land on the coast lying seaward of the mean high water mark and the area of land immediately adjacent thereto." Lakeshore areas may also be declared as beach. Dunes and other associated habitat landward of the beach are only protected if they are designated under the Act. Nova Scotia has 95 designated sites, which include significant dunes and other sensitive areas.

According to the regulations under *The Beaches Act*, *"mean high water"* mark means:
(i) the line on the seashore reached by the average of the mean high tides of the sea between the spring and neap tides in each quarter of a lunar revolution during the year excluding only extraordinary catastrophes or overflows; or
(ii) the line on the shore of a lake or river usually reached by the water after the great flow of the spring has abated and the lake or river is in its ordinary state.

Section 5 of the Regulations pursuant to the *Breakers Act* prohibits the removal of sand, gravel, stone or other material from a beach without a permit. This applies to dredging in intertidal areas. A permit is also required to construct a path, trail or road on a beach, build a structure, use a vehicle on a beach, or ride or walk a horse on a beach (draft policy). Moorings require a permit, although they are not listed as a structure. Owners of upland property are allowed to place a mooring within 200' of their property without a permit, provided they comply with federal fish habitat and navigation regulations. In addition, activities that affect freshwater and wetlands on Crown and private lands require permits and approvals through the NSDOEL.

Currently permits are required from both the NSDNR and NSDOEL for the construction of structures that extend into the water. To avoid this duplication, all activities in the water will eventually be handed over to the NSDOEL under the Activities Designation Regulations.

Dredging and construction activities in coastal waters fall under federal as well as provincial regulations. The NSDNR handles fish habitat regulations by reviewing a set of specifications provided by the Department of Fisheries and Oceans (DFO) during each application. If the use is considered non-conforming according to the fish habitat specifications, the NSDNR forwards the application to DFO. The NSDNR must also submit all applications for approval under the *Navigable Waters Protection Act,* which is administered by the Canadian Coast Guard. Dredging requires a removal permit from the NSDNR, a fish habitat assessment from the DFO and/or a federal environmental screening through Small Craft Harbours.

Municipal waterfront development projects that include dredging, boardwalks or look-off construction or bank protection must comply with the provincial and federal regulations. Once

structures and infills are completed they become municipal jurisdiction. On occasion, municipalities have created bylaws regarding the infilling of coastal waters. According to the NSDNR these bylaws are not legally binding, as the municipality has no jurisdiction beyond mean high water.

Mineral Resources Act and NS Reg. 12-97

Contact: Register of Mineral and Petroleum Titles, Minerals Resource Branch. Phone: (902) 424-8155.

Mining development activities are subject to an EIA under the NSDOEL's *Environment Act*. This process includes ensuring that the applicant complies with all relevant regulations, including water approval permits. Municipalities can get involved at the EIA stage or as landowners.

Section 72 of the mining regulations covers certain ground exploration activities in water supply areas and requires that the applicant seek all necessary approvals and permits from the NSDOEL. The NSDNR also recommends that applicants contact the water supply operator, as operators of water supply areas can apply conditions for land use under the *Environment Act*.

Draft Wildlife Habitat Management Regulations

Contact: Director of Wildlife, Wildlife Division. Phone: (902) 679-6139.

These draft regulations will apply to all forest operations on Crown and private lands, but not to the clearing of land for agricultural purposes. The intent is to mitigate the impacts of forestry activities on wildlife habitat, including freshwater watercourses and possibly some classes of wetlands. The regulations will require landowners or operators to establish a special management zone along the edge of watercourses. On watercourses 0.5 m or wider they will have to maintain 20 square metres of basal forest area within the management zone. In areas adjacent to watercourses narrower than 0.5 m, all trees can be harvested to the edge of the watercourse; however, operators will be required to minimize damage to small tress and shrubs. Vehicles will be prohibited within 7 m of the wider watercourse and 5 m of the smaller one. Forestry activities near a watercourse can also require a water approval permit from the NSDOEL under the *Environment Act*.

Wildlife Act

Contact: Director of Wildlife, Wildlife Division
Phone: (902) 679-6139.

Section 15 of the *Wildlife Act* gives the NSDNR the ability to designate wildlife management areas, which can include areas of coastal habitat, such as coastal islands. Each management area has its own regulations. In Nova Scotia the largest designation is the Eastern Shore Wildlife Management Area, a group of islands designated to protect nesting seabirds. The barachois behind Martinique Beach is an example of a wildlife sanctuary (Section 14 of the Act) designated to protect waterfowl. This designation prohibits hunting.

Wetland and Coastal Habitat Program
Contact: Wildlife Division. Phone: (902) 679-6224.

The Wetland and Coastal Habitat Program is a focal point within the Wildlife Division for the NSDNR's interest in wetlands and coastal habitats. Through a variety of partnerships, the NSDNR can acquire wetlands and adjacent uplands, such as coastal islands, for wildlife conservation. The Wildlife Division is currently working with farmers to protect wetland and riparian zones on agriculture properties through an incentives program under the North American Waterfowl Management Plan.

Wetland and Coastal Island Management—Municipal Level

The Wildlife Division of the NSDNR is working with SNSMR on a SPI for wetlands. The process includes determining how to use "Official Plans" and other provisions under the *Municipal Government Act* to manage wetlands at the municipal level. All wetlands of 0.5 ha or larger are mapped on GIS and this information is currently available to municipal planners. Some municipalities own offshore islands and can control land use indirectly, while in other cases, the municipalities have the option to zone islands for conservation or environmental open space use.

Integrated Resource Management on Coastal Crown Lands

The Integrated Resource Management Process for Crown Lands has a category which applies to Crown lands with conflicting values for land and resource use. In coastal areas these lands tend to have a variety of recreation, access and conservation values. The purpose is to make sure that all values are taken into account in the planning process. Crown lands under this category include: coastal islands; beaches; lands with a variety of recreation and aesthetic values; and lands with public access to freshwater lakes and coastal areas. Contact: Regional Resource Manager, NSDNR.

Nova Scotia Department of Agriculture and Fisheries

The Nova Scotia Department of Agriculture and Fisheries (NSDAF) brings together the government's policy, promotion and development functions for agriculture, commercial fishing, aquaculture, food production and sport fishing industries.

Salt water is primarily a federal jurisdiction, except in cases where the Province assumes responsibility, such as in aquaculture leasing. The Department has a memoradum of understanding with the DFO that gives the province jurisdiction over the water column with respect to aquaculture activities. Structures on the seabed, or extending from land into coastal waters, require permits from NSDNR. Municipalities can acquire this information on permits and aquaculture leases for planning purposes.

The Agriculture section of the NSDAF developed a SPI regarding agricultural land under the provisions of the *Municipal Government Act* in order to reduce land use conflicts. The

Minister can require that municipalities develop a secondary planning strategy that reflects the SPI. The Resource Stewardship Branch is currently working with farmers to protect wetland and riparian zones on agriculture properties through an incentive program.

Municipalities in Kings, Yarmouth, Cumberland and Hants have recognized that some farming practices pose environmental risk and have invoked municipal bylaws to address these issues.

Applicable Legislation

Fisheries and Coastal Resources Act
Agriculture Marshland and Conservation Act

Fisheries and Coastal Resources Act

Contact: Manager, Marine and Coastal Services. Phone: (902) 424-0406.

The intent of the Act includes fostering community involvement in the management of coastal resources and improving the fishery. The Act is implemented through regulations.

Aquaculture License and Lease Regulations NS Reg. 2000/31

Contact: Director of Aquaculture. Phone: (902) 424-3664.

Aquaculture operations require a license, which an applicant can acquire at a regional office. Planning staff can impose terms and conditions on the license, which include all relevant federal and provincial regulations. Most aquaculture operations in Nova Scotia are in coastal waters and require a federal EIA. Conditions of the federal environmental assessment also become conditions in the license. Some net-pen aquaculture activities occur in fresh water, and activities such as hatcheries require water approval permits from the NSDOEL.

Section 53 makes provision for aquaculture development zones. Under this section the Minister can impose conditions and restrictions on aquaculture activities in the water column. The Department has not currently established any aquaculture zones.

Sea Plants Harvesting Regulations NS Reg. 83/89

These regulations control the harvesting of rockweed and their intent is to maintain a sustainable industry. They include specific measures for harvesting that will protect the plants. For example, Section 5 (1) states that no person shall sever a rockweed plant from rock by any means other than by means of a cutting instrument. Section 6 states that no person shall intentionally harvest a rockweed plant in such a way that the holdfast is injured or is removed from the rock. These conditions become terms under the license agreement for rockweed operations.

Agriculture Marshland and Conservation Act

Contact: Supervisor Land Protection, Resource Stewardship Branch. Phone: (902) 893-6569.

This Act protects coastal lands behind dykes from development. The NSDAF lists dykelands as flood prone areas and consequently restrictions on development also reflect this risk. Each incorporated dykeland has its own plan, which becomes a regulation under the Act. Approximately 43,000 acres of coastal lands are protected and identified on GIS.

Dykelands with buildings placed upon them prior to incorporation fall under the grandfather clause of the Act, while new development requires a variance. The Resource Stewardship Branch contacts municipalities when a variance is applied for. The Resource Stewardship Branch of the NSDAF is currently working on criteria to direct applications for variances. Municipalities can use zoning bylaws to control development on dykelands. Kings County and West Hants have zoned dykeland as environmental open space, a listing that prohibits development.

APPENDIX C
Coastal Planning in Prince Edward Island (PEI): Relevant Jurisdictions and Legislation

Department of Community and Cultural Affairs

The PEI Department of Community and Cultural Affairs, Planning and Inspection Services Division, is responsible for land development in PEI. Planning is governed by the *Planning Act* and the Subdivision Development Regulations in conjunction with the *Environmental Protection Act* (EPA) through the Department of Fisheries, Aquaculture and Environment (PEIDFAE). The Department of Community and Cultural Affairs also administers the *Lands Protection Act, Archeological Sites Protection Act* and *Heritage Sites Protection Act*. The latter two fall under the Cultural, Heritage, Recreation and Sports Division.

Approximately two-thirds of PEI is under provincial planning jurisdiction in which the Province acts as its own development officer. Approximately a third of the province is incorporated municipally. The 75 municipalities in PEI have the option to adopt an official plan which meets, at a minimum, any province-wide minimum development standards identified in the *Planning Act*. The only province-wide regulation pertains to lot size requirements for on-site sewage disposal, contained in Section 23 of the Subdivision and Development Regulations. Twenty-seven municipalities have adopted official plans, which they implement through zoning bylaws. Municipalities without official plans adhere directly to provincial statutes and regulations.

Applicable Legislation

Planning Act
Subdivision and Development Regulations
Provincial Land Use Policy
Lands Protection Act
Archeological Sites Protection Act
Heritage Sites Protection Act

Planning Act, Subdivision and Development Regulations

Contact: Manager, Municipal Affairs Branch. Phone: (902) 368-4876; Manager, Provincial Planning Branch. Phone: (902) 368-4744.

These regulations define "*beach*" as that portion of land between the ordinary or mean high water mark and the water's edge and includes a distance of three miles seaward of the mean high water mark, and may contain sand, gravel, rock, clay, or other earthen material. "*Watercourse*" means the full length and width, including the sediment bed, bank and shore, of any stream, spring, creek, brook, river, lake, pond, bay, estuary or coastal water body or any part thereof, whether the same contains water or not.

"Wetland" means all freshwater and tidal areas that are or may be submerged or periodically submerged under freshwater or saltwater, including all bodies of water or areas commonly referred to as bogs, marshes, salt marshes, swamps, sloughs and flats."

Site Development Plans

Regulation B.14 (3) requires that subdivision applicants identify watercourses, wetlands, beaches, sand dunes, forested areas, designated natural areas or conservation zones, on or adjacent to the proposed subdivision.

Buffers Inside Coastal Area

Regulation B.16. (1) requires that subdivisions in coastal areas contain a natural buffer to protect specific coastal habitats from encroachment or the effects of development. This buffer must be a minimum width of 60 feet (18.3 m) adjacent to wetlands, watercourses and primary or secondary sand dunes and 60 feet or 60 times the annual erosion rate adjacent to beaches.[6] Access must also be provided to the beach or watercourse for the use of the owners of the lots if the property being subdivided includes frontage on a beach or watercourse.

In a coastal subdivision, the buffer zone is common land for residents of the subdivision and runs across all lots. Where the buffer is held in common, it can be part of or all of the required 10% open space set aside in all subdivisions with more than five lots.

Regulation A.3. (3) states that if the land to be subdivided includes a forested area adjacent to a wetland or watercourse, the application must be forwarded to the PEIDAFE to determine the boundary for the zone as a forested riparian zone, Section 11 of *EPA*. That Department can also require a wider buffer zone if necessary to protect the habitat.

Regulation B.16 (7) allows the Minister to order wider buffer zones if necessary to protect a beach, wetland or watercourse from the adverse impacts of contaminants discharged from proposed buildings or structures.

Building and Structure Setbacks

Regulation C.39 (5) requires that buildings and structures be set back from certain natural features. The nearest exterior portion of any building or structure has to be a minimum of 75 feet (22.9 m), or 60 times the annual rate of erosion, whichever is greater, from a beach; 100 feet (30.5 m) from a migrating primary or secondary sand dune; and 75 feet (22.0 m) from a wetland or watercourse. This includes any construction that is "fixed to, or sunk into land or water". This regulation excludes structures on federal lands. C.39 (7) Subsection (5) exempts certain buildings and structures used for fishing and boating from the setback. Development on tertiary dunes depends on suitability of soil, which is often

[6] The province has established erosion rates for the entire perimeter of PEI which are calculated in feet per year.

too permeable. All coastal municipalities having an official plan have adopted this setback.

C.39 (6) provides for greater setbacks if it is determined that this is required to protect the beach, wetland or watercourse from the adverse impacts of contaminants discharged from the proposed buildings or structures. Greater setbacks may be required as a condition of approval.

Any applications for development adjacent to a watercourse, wetland or dune, are subject to approval under the *EPA* and are referred to the Department of Fisheries, Aquaculture and Environment. Staff at that department may also determine that a greater distance is required between the building and the habitat in order to adequately protect the habitat.

Development on Primary and Secondary Dunes

Regulation C.40 (1) prohibits the development or construction of a road on any primary, secondary, or baymouth barrier sand dunes.

Regulation C.40 (2) requires that development permits may be issued for a building or structure on sand dunes other than primary, secondary or baymouth barrier dunes if the development is unlikely to disturb more than 10% of the sand dune; the lot significantly exceeds the minimum lot size requirements; or the development is unlikely to adversely alter the natural, topographical and biological features of the sand dune. A permit is not issued when a sand dune is naturally vegetated with spruce, fir, pine, cedar or larch species, and the coverage of these species exceeds 75% of the dune area.

Phasing Subdivisions

Regulation B.18 (1) requires that subdivisions be built in phases. B.18 (3) requires that 50% of the lots have to be built in the previous phase before approval for others is given. These regulations allow the Department to control land speculation along the coast where large parcels of agricultural land were set aside for future cottage development. This regulation, first applied in the coastal areas, now applies province-wide.

On-site Sewage Disposal Systems

Regulations for on-site systems are designed to address detrimental impacts on human and environmental health and safety. This is a provincial standard and applies to all subdivision and development activities in the Province. Minimum lot sizes are required to accommodate on-site sewage disposal systems, and requirements relate to water table depth and depth of permeable soil. Cottage development on the coast in unserviced areas is also affected by these regulations.

Regulation B.23 (1) defines lot sizes. Any application for on-site systems is referred to the Department of Fisheries, Aquaculture and Environment for approval under the *EPA*.

Stormwater Management

Regulation B.13 states that subdivision designs must be based on sound planning, engineering, and environmental principles and must provide for wastewater management, water supply and natural features. Applicants must provide a stormwater management plan for construction and post-construction phases of the subdivision prior to receiving final approval B.27 (1).

Shoreline Access

Regulation B.26 (2) allows planning staff to require certain conditions for preliminary approval, including providing residents of the subdivision with shore access to beaches or watercourses in the coastal area.

Offshore Islands

Regulation E.64 provides coastal islands with their own regulations, which prohibit the subdivision of land and construction on dunes or wildlife habitat. "*Wildlife*" is defined as "all wild life, wild mammals, birds, reptiles, amphibians, fish, invertebrates, plants, fungi, algae, bacteria, and other wild organisms, except those prescribed by regulation" (*Wildlife Conservation Act*). Summer cottages with their own water and sewer are the only developments allowed on islands in accordance with the requirements of the *EPA*. Lot size requirements are outlined in Subdivision Regulation B. 23.

Special Planning Areas

Section 8.1 in the *Planning Act* allows for the establishment of Special Planning Areas (SPAs)—designated areas other than municipal areas in which land use is controlled (e.g. Princetown Point-Stanley Bridge Special Planning Area). Regulations with specific controls to each SPA are contained in Part IV, Special Regulations of the Subdivision and Development Regulations. Regulations established for SPAs supercede those laid out in municipal plans and bylaws. The Department of Community and Cultural Affairs, Planning Division, prepares a management plan for each municipal planning unit, and the respective regulations are incorporated into the official plan for the SPA. SPAs having no official plan are governed under Provincial Subdivision Regulations enforced by province. There are three SPAs in coastal areas of PEI—Princetown Point – Stanley Bridge (Regulations 55, 56. 57, 58); Greenwich (Regulations 59, 60); and Borden Region (Regulations 61, 62).

Example of a Special Planning Area in PEI

Regulations in the Princetown Point- Stanley Bridge Special Planning Area are based on those originally contained in the Coastal Area Policy with some variation. They impose limits on subdivisions within 1,000 feet (304.8 metres) of the shoreline. No more than three residential lots are permitted within this area and the required unsubdivided land must meet specific dimensions with respect to the shoreline.

Coastal Municipalities

Some coastal municipalities in PEI have special considerations for planning in coastal or estuarine areas. The remaining municipalities with official plans have adopted the setback, buffer and watercourse alteration regulations outlined in the provincial Subdivision Development Regulations.

Charlottetown Official Plan

Charlottetown has incorporated the PEI coastal subdivision policies in its official plans and has made provisions for greater regulatory control of development adjacent to the coast and wetlands. An example includes Zoning Bylaw Section 4.38, which makes provisions for the development of yards on lands that include wetlands, a river bank or watercourse, or the top or toe of a cliff or embankment with a slope of fifteen percent (15%) or more from the horizontal. In these cases, the yard shall be measured from the nearest main wall of the main building or structure on the lot to the edge of the wetland or the top of the said cliff or embankment if such area is closer than the lot lines.

Zoning Bylaw 4.74.3 is especially pertinent to shoreline protection and states that the "Development Officer shall evaluate any subdivision proposal that is near a shoreline with respect to its impact on the shoreline environment".

Under the Federation of Canadian Municipalities, Charlottetown, as a case study, is working with Environment Canada to both develop a planning strategy and define a storm surge area.

Summerside Official Plan

The official plan (Policy 10.3.3) recommends a review of coastal management jurisdiction and responsibilities with the Province.

Stratford Official Plan

Stratford upgraded the provincial on-site septic system regulations in their Rural Residential Zone (RRZ), which is similar to the boundaries defined by the former coastal development area.

Septic systems need to be engineered and approved by the Department of Fisheries, Aquaculture and Environment.

Lands Protection Act

Contact: Senior Land Officer, Island Regulatory and Appeals Commission (IRAC). Phone: (902) 893-3501.

The *Lands Protection Act* and Land Identification Program Regulations deal with land ownership in PEI. Sections 4 and 5 under the Act refer to the limits of ownership set on corporations and non-resident persons who have to apply to IRAC to purchase lands. This application process occurs once cumulative land holdings exceed 5 acres (2 ha) or have greater than 165 feet (50 m) of shore frontage. As a condition, the land may be identified for non-development use only.

Archaeological Sites Protection Act and *Heritage Protection Act*

Contact: Heritage Coordinator, Cultural, Heritage, Recreation and Sports Division. Phone: (902) 368-5490.

The Heritage Coordinator participates on the technical review committee for development proposals requiring EIAs on lands under provincial planning jurisdiction.

There are no provisions in the *Archeological Sites Protection Act* aimed specifically at coastal or riparian areas. However, coastal areas tend to have a high percentage of archeological sites, particularly of First Nations origin. The Act provides mechanisms to designate sites and place restrictions on uses of these areas.

The *Heritage Protection Act* and its regulations allow for the protection of archeological and paleontological sites, cultural landscapes and built environments. This is a relatively new act and no areas have been designated.

Department Fisheries, Aquaculture and Environment

The *Environmental Protection Act (EPA)* is a central piece of legislation in Prince Edward Island used to regulate activities that affect the environment. Land use activities, which may have a detrimental affect on the environment, are directed through the *Planning Act* and are subject to scrutiny under the *EPA*[7]. The *EPA* is administered by Water Resources Division, Department of Fisheries, Aquaculture and Environment (PEIDFAE), and aims to protect the environment from the release of harmful substances. The Division is responsible for the management, protection and enhancement of the Province's groundwater, inland surface water, coastal estuaries, and programs related to the management of coastal sand resources, including the protection of sand

[7] The Act is currently under review. Anticipated changes are expected to affect land use activities adjacent to coastal and aquatic habitats.

dunes. The Division also regulates water and sewer infrastructure. Certain portions of the *EPA* are administered jointly with the Department of Agriculture and Forestry (PEIDAF).

The Act provides both proactive and reactive measures for protection, including the issuing of permits for certain activities and the investigation of other activities. Any applications for land use activities must come through the PEIDFAE before being approved. In addition to determining if a permit is required, staff may find that an EIA is necessary.

The Pollution Prevention Division administers a wide range of programs, legislation and activities that are designed to protect the environment in the Province. These include: air quality, protection of the ozone layer, management of hazardous wastes, litter, beverage containers, petroleum storage tanks, used oil, tires, lead-acid batteries, derelict vehicles, excavation pits, unsightly properties and special projects.

Habitat protection through conservation is covered under the *Natural Areas Protection Act* and the *Wildlife Conservation Act* within the Fish and Wildlife Division of the PEIDFAE. In some cases, if the activity is considered harmful to fish, the department will work jointly with the federal Department of Fisheries and Oceans to administer the federal *Fisheries Act*.

The Fisheries and Aquaculture Division provides an advocacy role for the Department in the area of marine fisheries management and supports development of the marine fishery and the aquaculture sector. Aquaculture activities in PEI are governed under a federal/provincial agreement on Commercial Aquaculture Development. In the mid-1980s, PEI created an *aquaculture zone* in estuaries, bays and inlets between headlands in which the water column could be used for aquaculture activities. Heritage Canada (then Parks Canada) and the provincial tourism department were involved in this zoning, which took into account potential conflicts with recreation in upland areas that could extend into the water (e.g. coastal access, parks). It also created an exclusion zone around federal parks and other areas needing special protection, such as Piping Plover habitat. In PEI, most of the areas suitable for aquaculture are leased, and currently marginal areas for mussel culture are being considered for possible leasing.

There is recognition within the PEIDFAE of the conflicts between cottage development and aquaculture, and the need to develop a cooperative approach between land use planning and aquaculture. Contact: Aquaculture Program Manager, Fisheries and Aquaculture Division. Phone: (902) 368-5252.

Applicable Legislation

Environmental Protection Act
Natural Areas Protection Act
Wildlife Conservation Act

Environmental Protection Act

The *Environmental Protection Act* (EPA) is a central piece of legislation in PEI used to regulate activities that affect the environment. The *EPA* regulates discharges to air, water, or onto land by establishing a broad prohibition against discharging a contaminant into the environment, unless the discharge is permitted by the regulations or by the Minister. Under the *EPA*, *"watercourse"* includes freshwater, estuaries and coastal waters. *"Wetlands"* consist of all fresh and tidal areas that are or may be submerged or partially submerged, including areas commonly referred to as beaches and flats. The *EPA* is implemented by provisions in the Act itself and through a series of regulations enforced by departmental staff in the various divisions.

Environmental Impact Assessment

Under Section 9 of the *EPA*, a developer who is planning an undertaking must first file a proposal to the PEIDAFE and must receive written approval from the Minister to proceed. The Minister may order an EIA of any undertaking that requires approval, and may also notify the public and invite the public to give their comments. A Technical Review Committee makes a detailed examination, and in the case of strong public interest, the Minister, may appoint a review panel to hold public meetings. The environment as a whole (air, land, water, plants, animals and human life and groundwater) is considered. When the process is complete, the Minister decides whether to approve or deny the undertaking. Any approval might be subject to special requirements or regulations.
Contact: Environmental Assessment Coordinator. Phone: (902) 368-5274.

Watercourse Alteration Permit

Section 10 of the *EPA* establishes a permit system to regulate activities that may alter a watercourse or wetland. Activities requiring a permit include damming, river diversion, altering land or water levels and any construction in a watercourse or wetland and within 10 m of adjacent lands. Wharves and breakwaters require a permit. Permits are not required for activities that are covered under provisions for watercourse buffer zones found in Section 11 of the *EPA*, including cutting trees or ploughing farmland.

Permit applications are reviewed by a Watercourse Alteration Committee, established under Section 11 of the *EPA*. The Water Resources Division issues the permits and helps to implement permit requirements by providing landowners with guidelines for development.

Comprehensive Watercourse Buffer Zone

Sections 11.1 to 11.4 of the *EPA* establish buffers to regulate activities near watercourses. The PEIDAF is also involved in the administration of activities in these buffer zones. In order to be approved, activities in buffer zones must also comply with the *Planning Act* and the Subdivision and Development Regulations administered by the Department of Community and Cultural Affairs.

The *EPA* defines three types of buffer zone that can be applied to watercourses:

Forested riparian zone: A buffer between 20 and 30 m (depending on slope) is required in all forested areas that border on watercourses and wetlands. Restrictions in this zone cover pesticide application, construction of ditches, operation of heavy machinery, exposure of soil, and tree cutting.

Intensive livestock zone: New livestock operations or the construction of livestock-related facilities is not permitted within 90 m of a watercourse. Existing operations and facilities require a buffer zone of between 20 and 30 m depending on slope. However forage crops can be produced in this buffer zone.

Non-forested land zone: This zone applies to agricultural land under crop production and land under development. On agricultural land, crops (with the exception of forage crops) cannot be planted within 10 m of a watercourse. Restrictions apply to the production and harvesting of forage crops, the planting of row crops adjacent to the buffer zone and planting winter cover crops and fall tillage on slopes upland of the buffer zone.

Land development on non-forested land requires a 10 m buffer zone within which activities relating to the planting and management of lawns, trees and shrubs are permitted. Disturbance of soil or cover vegetation by dumping or excavating are restricted in this zone.

The buffer zones are applicable in all inland and coastal areas with the exception of *"landlocked ponds, man-made ponds with no permanently flowing outlet, the perimeter waters of PEI, drainage ditches and intermittent streams and springs that do not have a defined sediment bed and flow defining banks and do not exhibit flow during any 72 hour period, from July to October 31 of any year."* The buffers do not apply to the perimeter coastline of PEI, but do apply in some bays, as well as estuaries and inlets.

Water Wells

Regulations under Section 12 of the *EPA* require a permit for the construction of a well. The intent is to prevent the alteration of stream and lake levels by overuse of ground water supplies for irrigation. In PEI, 75% of water in streams originates from groundwater.

Sewage Disposal

Section 13 of the *EPA* requires a license to construct an on-site sewage disposal system. The intent is to prevent groundwater contamination or the release of contaminants into the environment.

Discharge of Contaminants

Sections 20 and 21 of the *EPA* cover the release of any substance into the environment that may be harmful. Discharges include a solid, liquid, gas, vibration, waste, odour, radiation, sound or combination of them that is foreign to or in excess of natural constituents of the environment into which they are being introduced.

Under Section 21 there is a legal obligation to report a known discharge and fix the problem through remedial action. The Investigation and Enforcement Division develops remedial action in conjunction with those divisions responsible for the problem. If the discharge is considered harmful to fish, the PEIDFAE will involve Fisheries and Oceans Canada.

Sand Dunes and Beaches

Section 22, *EPA*, protects dunes and beaches by prohibiting vehicular traffic on or across them, and prohibits any activities that can interfere with the natural process of dune succession. The exceptions apply to vehicles being operated for the legal removal of a fishery resource or sand. Development adjacent to sand dunes requires an EIA.

Under the *Sand Removal From Beaches Regulations,* individuals can remove sand from below the high water mark for personal use. Commercial operations require a permit and are only permitted above the high water mark. Under the Excavation Pit Regulations no one can excavate within 200 m of a watercourse.

Wildlife Conservation Act

The *Wildlife Conservation Act* provides for the establishment of Wildlife Management Areas, thereby restricting uses. Individuals can put restrictive covenants, identifying allowable activities, on any lands. Contact: Protected Areas and Biodiversity Conservation. Phone: (902) 368-4807.

Natural Areas Protection Act

A plan to implement the *Natural Areas Protection Act* allows a committee to target habitats for protection under the Significant Environmental Areas Program. Ninety per cent of PEI's sand dunes are targeted for protection. Other coastal habitats include salt marshes, islands and barachois ponds and private lands.

PEI Department of Agriculture and Forestry

The Department of Agriculture and Forestry (PEIDAF) is involved in the implementation of the *EPA* as it relates to buffer zones for forested and agriculture areas. It shares the responsibility for administering watercourse buffer zones (Section 11 of the *EPA*) with

the PEIDFAE, which is responsible for enforcing the regulations under the *EPA*. The role of the PEIDAF is primarily one of education and enablement.

Under the Agriculture and Environment Resource Conservation program (AERC), district offices of the DAF can help landowners comply with the buffer zone legislation in agricultural and forested areas. This includes providing financial incentives as well as technical support. In order to be eligible for assistance under this program, landowners must submit a land management plan, which includes conservation measures. These measures are designed to reduce soil erosion and run-off, provide habitat, keep livestock out of streams and reduce pollution caused by the improper storage and use of pesticides and farm fuel. In forested areas, support includes technical advice on selective harvesting and other educational assistance to landowners under the Forest Renewal Program.

Buffer zones only apply to inland waters and estuaries, excluding perimeter coastline, wetlands and some landlocked aquatic habitats. A review of the Act is taking into consideration the need to include wetlands, such as salt marshes.

The Department is also working on best management practices for agriculture under the Agriculture and Environment Resource Conservation Program. Contact: Manager, Sustainable Agriculture Resources Section. Phone: (902) 368-4705/6776.

PEI Department of Transportation and Public Works

The Department of Transportation and Public Works administers the 8.5% of land in PEI that is provincially owned, but allocates the management of these lands to other government departments.

The Department of Transportation and Public Works administers a resource fund established from sales of "undesirable" provincial land, and which is used to acquire priority properties. In addition, this Department is recommending that all coastal provincial lands be identified as high priority and remain under provincial jurisdiction in the long-term.

Land Identification Program

Any provincial land for sale is identified and has a restrictive covenant applied to it that restricts development and subdivision, thereby maintaining the land for resource use only. Contact: Manager of Provincial Lands, Properties Section. Phone: (902) 368-5131.